SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1904.—Vol. XLII. LONDON, SATURDAY, FEBRUARY 17, 1872. {PRICE .... FIVEPENCE. PER ANNUM, BY POST, £1 4s.

Original Correspondence.

PATENT FURNACES IN SCOTLAND.

While the great ironmasters of Philadelphia, U.S., and Staffordshire, are investigating the merits of Danks's patent rotary-furnace, the Scotch ironmasters are still conducting experiments with other furnaces, more or less generally known, that have been before the world for a longer period. Among these we may specially mention the Howatson furnace, the Swedish gas furnace, and the Gorman heat-restoring gas furnace. Siemens's regenerative furnaces are not forgotten, but their distinctive merits and peculiarities are so well understood that it would be the height of superfluity to refer to them here, further than to remark, *en passant*, that they have recently been adopted on rather an extensive scale at the Blochairn Ironworks, the largest establishment of its kind in Scotland, while the Parkhead Forge, situated about two miles from Glasgow, has also resolved upon their introduction. In reference to the Gorman furnace, about which little is known, and in which several important improvements have recently been effected, including adaptations to puddling and heating iron, some information may be desiderated. This furnace has recently been subjected to severe crucial tests, in which it has come off with flying colours; and at one of the largest ironworks in the neighbourhood of Coatbridge experiments are still being carried out, in order to test its claims to superiority over all other furnaces in the market.

Mr. Gorman's heat-restoring gas furnace was first constructed at the Govan Bar-Iron Works, in the year 1864, since which time it has received the patentee's constant attention. In developing his patent, Mr. Gorman's great aim was to economise fuel by restoring part of the heat which escapes in ordinary furnaces. In practice it was found that the arrangements necessary for this purpose were also admirably adapted for consuming the volatile gases of coal, thereby increasing economy and preventing smoke. As is well known, the coke, or solid part of the coal, is completely burnt on the grate of the ordinary furnace, and the combustion of the gaseous part of the coal thus prevented. In the heat-restoring gas furnace, however, the solid part of the coal is converted into carbonic oxide gas, which is combustible, and which along with the coal is burnt with a further supply of air in the part of the furnace where the heat is wanted. The gas furnace has been successfully applied in re-heating for plate and bar mills, in puddling, in welding scrap, and for all shipbuilding purposes. So general has its use become in the neighbourhood of Glasgow that we find it used for boiler-makers, bridge-builders, and rivet and nail makers, while it is also successfully applied by the Coatbridge Tin-Plate Company for enameling and annealing.

The use of the Gorman furnace being so general it must, one would think, have very conspicuous and definite advantages over the ordinary reverberatory furnace. The principle of action, to begin with, is entirely different. It is heated by combustible gases, which may be supplied from any suitable source. The gas used for illuminating towns, or the gases escaping from blast-furnaces, will answer the purpose admirably. It is not essential that the gas should be produced in connection with the furnace, although hitherto it has been produced in the apparatus attached from the ordinary coal or slack procured in the neighbourhood of Glasgow. The gas producer occupies the same place as the grate-room in ordinary furnaces, the only difference being that it is deeper, to allow at all times a thickness of over 2 ft. of fuel on the grate-bars. This provision is necessary to prevent carbonic acid from rising among the combustible gases. The proper working of the producer has hitherto been either little understood or greatly neglected, and hence a great impediment has been thrown in the way of the legitimate results which, under proper management, the furnace will unfailingly yield. The conditions laid down by the patentee are—keep the bars clean, taking out clinkers, but no coke or charred coal that can be avoided; fire often, and keep the fuel up level with the firing door, or higher, at all times, but do not put too much on at a time.

To transfer the heat from the waste products leaving the furnace to the air entering the furnace for combustion, an apparatus called a heat-restorer is employed. This instrument consists of two tubes, the inlet of one tube adjoining the outlet of the other. The tubes are open at both ends, and they are so constructed that if hot water be poured in one tube, and cold water in the other, the hot water will run out cold, and the cold water will leave the instrument heated very nearly to the temperature of water which was poured in hot. In the same manner the restorer transfers the waste heat to the air for combustion. The restorer is a chamber placed usually under the ground line, and into which is placed a number of fire-clay pipes, open at both ends. At each end of the pipes a wall runs up, and divides the chamber into three compartments. The flame or waste heat from the furnace passes downwards through the centre compartment, impinging on the outside of the tubes placed therein; and the air for combustion, entering the end space at the bottom, passes through the pipes to the other end, from which it rises to a higher series of tubes, and re-crosses until it arrives at the top of the chamber. An upward current of air thus meets a downward current of heated gases, with only the thickness of the fire-clay tube between them, the current of air inside preventing the destruction of the tube by the high temperature outside.

So much for the construction and *modus operandi* of the Gorman furnace. The next and most important consideration relates to the results obtained in actual practice. As we have already indicated, many experiments have been and are now being carried out with the view of testing its merits. Recently the Mossend Iron Company carried out a series of trials in order to compare the waste of iron in the heat-restoring gas furnace with that of the ordinary furnace. The results were as follows:—Seven heats were charged in succession in the common furnace, No. 5. The iron was in piles for large angle-bars, and the weight delivered was 211 cwts. 3 qrs. 7 lbs., of which there were returned 190 cwts. 3 qrs., representing a loss of 21 cwts. 0 qrs. 7 lbs. The yield was, therefore, 22 cwts. 2 qrs. 10 lbs., or a waste of 2 cwts. 2 qrs. 10 lbs. in producing a ton of angle-bars. There was charged at the same time, and of the same weight and quality of iron for the same order, seven heats in succession into No. 7 gas furnace. Delivered 212 cwts. 0 qrs. 7 lbs.; returned, 195 cwts. 2 qrs. 0 lbs.; loss, 16 cwts. 2 qrs. 7 lbs.; the yield being, therefore, 21 cwts. 2 qrs. 21 lbs., or a loss of 1 cwt. 2 qrs. 21 lbs. in producing a ton of angle-bars, showing a saving in iron by the gas furnace of 3 qrs. 19 lbs. per ton of iron produced, including croppings. The next experiments to which we shall refer were made at the works of Messrs. Colville and Gray, Coatbridge, who weighed the materials during a week's work of the gas furnace and two common furnaces, the results being as follows:—

	Charges of puddled bars.	Finished iron and croppings.	Puddled bars.
Common furnace, each..Tons	58 2 0 14	53 5 0 14	1 1 3 25
Gas furnace, each	55 10 2 14	52 10 3 14	1 1 0 17
Saving per ton of iron			0 0 3 8
Coal—Old furnaces, each ....Tons	25 17 0 0	....per ton	0 9 2 23
Gas furnace, each	12 7 0 0		0 4 2 25
Saving per ton			0 4 3 26

Estimating the above yields in finished iron, without cropping, and allowing 5 tons charged to finish 4 tons, we have the following result:—

Common furnace ....Tons	1 1 3 25 × 5·4 =	1 7 1 24
Gas furnace	1 1 0 17 × 5·4 =	1 6 1 21
Saving on finished iron per ton		0 1 0 3

The following statement of two weeks' work of four of Gorman's heat-restoring gas furnaces, at the works of Messrs. Gray and Wylie, Clifton Ironworks, Coatbridge—employing heating iron for rolling-mills—will still further illustrate the results attainable by this furnace:—

SIXTEEN INCH MERCHANT MILL.

1871—April 3—Day shift ....Tons	15 12 2 0	
„ 3—Night shift	11 3 2 0	
„ 4—Day shift	14 13 3 14	
„ 4—Night shift	15 11 0 14	
„ 5—Day shift	14 7 3 21	
„ 5—Night shift	14 12 2 0	
„ 6—Day shift	12 19 3 21	
„ 6—Night shift	15 7 3 7	
„ 7—Day shift	12 6 1 0	
„ 7—Night shift	13 12 0 0	
„ 8—Day shift	12 17 0 14	
First week	153 4 0 7	
1871—April 10—Day shift ....Tons	17 3 1 14	
„ 10—Night shift	12 18 3 0	
„ 11—Day shift	12 13 1 0	
„ 11—Night shift	11 11 1 21	
„ 12—Day shift	16 11 1 21	
„ 12—Night shift	15 3 3 7	
„ 13—Day shift	13 18 1 7	
„ 13—Night shift	11 16 2 21	
„ 14—Day shift	14 10 1 21	
„ 14—Night shift	13 17 0 7	
„ 15—Day shift	13 16 2 14	
Second week	154 11 0 21	
First week ....Tons		153 4 0 7
Second week		154 11 0 21
Total		307 15 1 0

making a total for 22 shifts from two furnaces, of, as near as may be, 14 tons per shift:—

EIGHT INCH GUIDE MILL.

1871—April 3—Night shift ....Tons	10 9 3 14	
„ 4—Day shift	12 1 3 14	
„ 4—Night shift	13 7 3 0	
„ 5—Day shift	11 9 0 7	
„ 5—Night shift	13 11 0 0	
„ 6—Day shift	10 19 0 7	
„ 6—Night shift	11 18 0 4	
„ 7—Day shift	10 16 2 7	
„ 7—Night shift	14 0 3 7	
„ 8—Day shift	9 1 0 21	
First week	117 15 1 7	
1871—April 10—Night shift ....Tons	12 2 0 21	
„ 11—Day shift	6 19 3 14	
„ 11—Night shift	10 7 0 7	
„ 12—Day shift	11 15 1 0	
„ 12—Night shift	10 7 3 21	
„ 13—Day shift	11 11 1 0	
„ 13—Night shift	11 13 3 7	
„ 14—Day shift	12 8 3 21	
„ 14—Night shift	9 19 1 0	
„ 15—Day shift	12 13 1 0	
Second week	109 18 3 7	
First week ....Tons		117 15 1 7
Second week		109 18 3 7

The total from the two furnaces for 20 shifts being 11 tons 7 cwts. 2 qrs. 23 lbs. per shift.

It may be desirable to explain, in reference to the above statement, that the iron delivered for the—

Sixteen inch mill on the night shift, April 12, was ....Tons	19 9 2 4
The iron returned, including croppings	18 6 0 21
Loss in heating	1 3 2 11
Finished iron	15 3 3 7
Croppings	3 2 1 14
The coal or triping used was	3 4 0 0
So that the puddle bar required to produce a ton of rolled iron is..	0 21 1 4
The coal (triping) necessary to heat a ton of iron	0 3 1 27
The finished iron from 16 inch mill was	307 15 1 0
Ditto ditto including croppings	362 0 0 0
Iron charged cold into the furnace	395 0 0 0
The finished iron per shift averaged	14 0 0 0
Ditto ditto including croppings	16 9 0 0
Iron charged cold, per shift	18 0 0 0

Of the various modifications of this furnace introduced by Mr. Gorman we cannot now speak. We may, however, remark that he has brought out a new form of puddling furnace, which is being successfully worked at the Clydesdale Ironworks, Holytown, and other places in the West of Scotland. He is also engaged at the present time in applying his principle to smelting, and to smiths' and founders' furnaces.

IMPROVEMENTS IN TREATING METALLIC ORES.—The objects of the invention of Messrs. HARGREAVES and ROBINSON, of Widnes, are to completely oxidise or decompose sulphides and to utilise the greatest possible quantity of sulphur contained in metallic ores, and to convert the oxides and sulphides of certain of the metals contained in the said ores, such as copper, zinc, tin, lead, silver, and gold, into chlorides, or to render them otherwise available by the action thereupon of chlorine or hydrochloric acid gases at elevated temperatures. Pyrites is referred to as the metallic ore to be operated upon; others are suitable. Burnt and spent pyrites are referred to under the second part; other metallic oxides are suitable. Under the first part the pyrites is maintained at a high temperature in tall vertical or other retorts or burners until the whole of the sulphur is oxidised. The pyrites is burnt in series or sets of retorts or burners, so arranged and connected that each retort or burner in its turn becomes the first, intermediate, and last of the series as regards the passage of the air and gases therethrough. The retorts or burners consist of vertical, circular, elliptical, or square tubes, preferably heated on the outside. Under the second part of the invention the spent pyrites is maintained at a suitable temperature—say, from 700° to 900° Fahr.—in the above or any convenient vessel. In a current of chlorine or hydrochloric acid gas, or vapour, passed through, over, or amongst the mass.

THE MINES INSPECTION AMENDMENT ACT—No. IV.

TO THE EDITOR OF THE MINING JOURNAL.

SIR,—The Home Secretary has lost little time in introducing his Mines Inspection Amendment Bill, read the first time on the 12th, and he will, I trust, lose none in getting it passed into law; for though far from doing all that might be done and ought to be done for the protection of pitmen in their hazardous employment, it contains many valuable provisions, and others will, I hope, be introduced during the progress of the measure through Parliament.

The Bill is not confined, as the present Act is, to coal mines and iron mines in the coal measures, but applies also to stratified iron mines, and to shale and fire-clay mines. It contains provisions for the employment and education of young children similar to those of the Factory Acts. As a general rule, payment for coal got is to be by weight, and by the imperial ton; when the change will be exceptionally inconvenient or costly, the Secretary of State, on a special report after enquiry, may allow exceptions. An existing Act, passed shortly after the disaster of the Borradon Mine, provides that from every mine there shall be at least two shafts or modes of exit: the present Bill provides that this shall be a real and not an illusory precaution. Mr. Secretary Bruce noticed the common error of those who form their opinions of the dangers of mining from what is most frequently reported—viz., that explosions are the accidents most destructive of life. In one year indeed, 1866, 651 deaths out of a total of 1484 were so caused, but the average proportion is little more than one-fifth, having been in twenty years 4711 out of 20,653 total deaths by coal mine accidents, or 23·6 per cent.; in 1870 they were 18·5 per cent. The average loss of 235 lives a year from this cause, most of which are needlessly sacrificed by carelessness or cupidity, is a disgrace to our country, which the present Bill, unless amended, will partially, but only partially, remove.

It would, however, be unjust to deny that important amendments of the law are proposed in the Bill. It contains the important provision that for every mine there shall be a *registered* manager, and that every manager not previously so employed shall undergo an examination of a strictly practical character; those not examined to give proof of sobriety, ability, and general good conduct. The proof that such duties have been properly performed ought to be evidence of ability to perform them. This certificate of competency the manager may lose wholly, or for a time, if on enquiry by competent persons he be found to have neglected his duty, but the Bill ought, and I hope will, provide that such enquiry be made after every accident causing loss of life, *apparently* arising from bad management. If it have so arisen, the manager should be censured or punished, if the suspicion be erroneous, he should be honourably acquitted; but every case of even suspected neglect, involving loss of life, should be followed by a strict and impartial investigation.

As before stated, less than a fourth of the lives lost are destroyed by explosions, half of the remainder, or, on the average, 395 a-year, being lost by falls of roof or of coal. The accidents by which more than one life a day is thus lost, though they cannot be entirely avoided, will be very considerably diminished in frequency, if the common-sense practice long followed in the better managed mines of Durham, Northumberland and Scotland were rendered universal, as is proposed in the Bill. In the North it is, and long has been, the common practice for the mine owners to take care that the workings are kept in a proper state of stability. They employ men to fix the props and sprags needed to support the roof and coal, and though, like all all other human work, this is done imperfectly, it is done far less imperfectly than when done by the pitmen themselves, who are both less skilful and less careful than those specially employed for work requiring special skill and care. Moreover pitmen, who are paid for the coal they get but not for time otherwise occupied, are apt to begrudge work for which they are not paid, even if needed for their own safety. They take good care, however, to complain if others employed to do what is needed for their safety neglect it, the effect being that the work is much better done and more strictly looked after, whereby accidents of this class, which are most destructive of all, are materially diminished. This simple change of law, by compelling all coalowners to do what the most skilful and successful have long done of their own accord, will certainly save many, not improbably 200, lives a-year, and perhaps a thousand broken limbs, and other serious though not fatal injuries.

Next come restrictions upon the use, or rather the gross abuse, of gunpowder. Everybody acknowledges that no naked light should be used in the neighbourhood of explosive gas, and all safety-lamps should be locked so that they cannot be opened except where it is safe to open them, and yet the very same persons who punish, and justly punish, a pitman for smoking his pipe in a fiery mine (thereby endangering the lives of others), will knowingly permit blasting by powder in a similar mine, although such blasting is not merely as dangerous as a lighted pipe, but far more dangerous, for it may not only ignite gas in its immediate neighbourhood, but cause it to be ignited at a distance by driving it against an imperfectly protected light. The Bill very properly provides that the use of gunpowder shall be limited to that used in cartridges, and prohibited entirely in mines in which safety-lamps are directed to be used.

A general rule of the existing Act imposes upon the owner and manager the duty of having the mine inspected as to the efficiency of its ventilation every day before the work begins. In well managed mines this very important precaution is carefully observed, with the effect of nearly entirely avoiding in them those large explosions by which many are killed at once, which rarely occur unless from the gradual accumulation of gas. It is proposed to add to this a direction that whenever danger becomes apparent the men shall be withdrawn from the mine; and it is further provided that they may from time to time, at their own cost, employ one or more of the pitmen, accompanied by anyone the owner shall appoint, to examine the mine and satisfy themselves as to its safety. Mr. Secretary Bruce informs us that some owners pay men to perform this important service, who are rewarded, instead of being blamed, if they detect any source of danger. Why should not all do so?

The service is so important, and it would be of such advantage to the community at large that it shall be well and universally per-

formed, that it is a pity that it should be left contingent upon the men being wise enough and prudent enough to be willing to pay for its performance. It signifies little who pays for it directly, for if the charge be made universal it will be an addition to the cost of the coal got, and be paid indirectly by the consumer, who will neither feel it or complain of it if he did. The cost of the precaution would be perfectly insignificant compared with its value. Are human lives worth nothing? Any perceptible diminution in the 1033 lives a-year now lost in coal mines would well repay in mere money value many times the cost of so evidently valuable a precaution by which many lives would be saved.

The next alteration of the law is the omission of the words "under ordinary circumstances" in the general rule directing that the working places of all mines shall be so ventilated by the owner as to be safe. Those unfortunate words have sheltered many owners guilty of neglecting a precaution essential to the safety of hundreds from just responsibility. It is clear that the working places should always be safe while men are working in them, and that the owner should be responsible for keeping them safe, or if from any temporary cause the fire-damp shall collect faster than the ventilation can carry it off, or dilute it, the men should be withdrawn from danger. It is not enough to enact that this shall be done, it must be made the direct and immediate self-interest of the owners that it shall never be neglected.

PHILO.

THE RATING OF COAL MINES.

SIR,—I have seen and read with great pleasure many letters published in the Journal on this subject, and now Parliament is again at work I hope your subscribers will again do their best to invite its attention to our sad position. Our Assessment Committee is principal composed of dependent men, such as tenant farmers, publicans, shopkeepers, brickmakers, or agents, &c., and not men altogether independent and out of business, consequently there is a reason why the law of valuing mines and rating them on their value according to law is not put into force. All that is wanted is a short Bill, stating that *all mines shall be valued once a year* (and not left to the option of the committee) by a competent mining man, and the rate made on his valuation, leaving it in the power of persons, as now, to appeal. A bad feeling is growing up amongst us, which has been, I am sorry to say, increasing in intensity, and will soon come to an outburst unless our Government sets the matter at rest. Hithereto the greatest moderation and consideration have been shown by the ratepayers, who have complained of a want of justice, but unless something is done a great and terrible outburst and resistance to the payment of rates at all will take place. I trusting to our Government seeing the importance of this little matter.

INHABITANT.

Stourbridge, Feb. 14.

THE RATING OF COAL MINES.

SIR,—I see in the programe of our Government for this session a Bill is to be brought forward under the above head, and as we poor people in the Stourbridge Union have for years been subjected to unjust rating of mines, and not according to law, it is only natural for us to ask if the Bill now contemplated by the Government is intended to bring about a better state of things than has prevailed, and does prevail, in this Union, and no doubt elsewhere? We are told that the law is clear—that all property shall be rated on what it is worth to rent from year to year—*i.e.*, on a valuation, or on the rent paid for it, as the Assessment Committee may resolve, as our farms and shops, &c., are. But what are we to do, when the Assessment Committee chooses to enter into a bargain with the colliery owners to rate them at less than half the value of the mines to rent? Our answer is that, until Assessment Committees are bound by law to employ a fit and competent person to value and rate the mines at least once a year we poor ratepayers may feel sure there is no hope for us. Our Assessment Committee are now rating our mines on a scale which is considered less than half their value. This bargain between the Assessment Committee and coalowners was entered into some year or two ago, after a great public demonstration, which had the effect of reducing our rates from 1s. 8d. to 1s. By some this bargain is called the banditti bargain, by others unjust compromise, by others to skin the poor alive to make shoes for the rich bargain; and it is openly said that great distrust prevails, without hope for the future unless our Government make the law, as before stated, so clear that the Assessment Committee shall have no choice in bargain-making of the unsatisfactory character above referred to; but let it be their unalterable duties to have the mines valued once a year for rating (mines being more changable than other property). And let the rate be made on the declared value of such person, and let the valuation be for mines alone, and not bundled up with damaged land and other things, so as to render it unintelligible.

It is also important that each colliery owner shall be bound by law to make a full return of all the coal he raises, and the selling price. We are now told that no one has a right to ask to see the return of a coalmaster as to the quantity of coal raised, &c.; if it be so it is unjust to us as free ratepayers, so long as all particulars on which I am rated are open to all, and the particulars on which my next-door neighbour's rate is made to be kept a perfect secret. Let the lease of all our rates be kept open, so that we may all be kept honest by the eye of the public being upon us; or let all be secret, and each man do as best he can, or will—"what is good for each is good for all." Fair play is all that we ratepayers ask for. We have raised our long and loud cries during the last two years before the Government, and as yet we have had no help; and, we ask, shall this inglorious, unrighteous state of things continue? God forbid.

Pensnett, Feb. 13. X. Y. Z.

MINERAL INDUSTRY OF SILESIA.

SIR,—After the last war with France a great many new companies have been formed in Breslau, principally with Silesian capital, and all of them, with the exception of one or two, are thriving. The trade has so increased that new railways have become a necessity, some are already commenced, others only yet projected; the want of railway wagons, which at times has been very severely felt here, will also soon be remedied by the newly-established Breslau Railway Wagon Company, which already has delivered a great number of wagons. Besides the railways, it is also intended to make the river navigation more available, for which purpose a river steam navigation company is now being formed, which will be able to carry the staple articles, as coal, iron, oil, spirits, &c., to Stettin, Berlin, &c., at very low rates.

Amongst the new companies, besides the four banks, which although established only about six months ago, to-day are quoted as follows:—Breslauer Wechslerbank, 160; Breslauer Disconts Bank, 145½; Breslauer Maklerbank, 145; Breslauer Makler Vereinsbank, 124¾;—the principal and most promising enterprise, the Vereinigte Laura and Konigshutte, capital 6,000,000 thalers. The property consists principally of two colossal ironworks and coal and iron mines. The two ironworks are called Laurahutte and Konigshutte, the first formerly the property of Count Henckel, of Donnersmarck, the latter until last year the property of the Government, but then bought also by the Count Henckel, of Donnersmarck, who made the highest bid when the Government put it up for sale by auction. These two works, with the coal and iron mines of Count Henckel, form now the property of the company; all the works of the company are in excellent condition, and the output of the coals, as well as the production of pig and rolled iron, are on the increase.

During the first half-year of the company's existence, which dates from July 2, 1872, there have been produced—coal, 5,740,000 cwts.; pig-iron, 862,725 cwts.; rails and sheets, 639,653 cwts. At present the output of the coal mines does not yet suffice for all requirements of the works, but in the course of a year there will not only be sufficient coal to satisfy the whole demand of the works, but also a considerable quantity will remain for sale, as a coal field to which but little attention has hitherto been paid has now been discovered to be one of the richest fields in Silesia.

The greater part of the pig-iron produced by the company is used by the puddling and rolling works of the company. The conditions of sale have been very favourable for manufactured iron for the company, the quantity exceeded the maximum of every previous half-year, and still a good many orders could not be accepted. The increased enquiries caused naturally a rise of prices, and at the present moment they are higher than they have been for 10 years, and there is every prospect that this state of affairs will continue, as the company has orders on its books which will give the works employment for more than a year, and there is a certain prospect of large contracts with railway companies. Under these circumstances a good dividend will be paid early this year, but at the same time the board of directors has resolved to devote a large part of the profits to a still further improvement of the works and mines. The shares, which were issued at par, are to-day quoted at 135. The price of iron is at present—bars, 12*l.* to 12*l.* 10*s.* per English ton; best charcoal sheets, 21*l.* ditto, at the works. Large coals best quality, about 12*s.*; nuts, about 9*s.* per ton at the pit's mouth.

The affairs of the Silesian Zinc Company (capital issued 7,300,000 thalers) have reached such dimensions that the board of directors has at last yielded to the wishes of the director-general, Mr. A. Schmoeder, under whose circumspect and energetic management the quantities of sheet zinc manufactured have increased from about 45,000 to above 270,000 cwts. per annum, and the price of the shares from about 40 to 103 to-day. To separate the commercial from the technical direction, Mr. S. retains the commercial department, and the technical direction passes into the hands of a Royal Counsellor of Mines of great experience. The company which last year paid a dividend of 8 per cent., will this year probably only pay 6 per cent., because it has been resolved to add a large sum to the reserve fund, but the next year a much higher dividend is anticipated, because the company possesses large coal mines, one of which, the Mathildegrube, with an output of about 300,000 (English) tons per annum. The coal has so considerably increased in price that the sale of the quantity not required by the works will give 300,000 thalers more.

The price of spelter here shows not the least sign of a downward tendency. While in England the price has again considerably receded, here 7 to 8 thalers per cwt. has just been paid; and, after adding the low freight by water from Breslau to Hamburg (the navigation has not yet re-opened), freight from Hamburg to London, insurance, landing charges (taking the difference in weight between English and toll weight into consideration), this is at least equal to 23*l.* 10*s.* to 23*l.* 15*s.* per English ton delivered in London. If, after the English market is cleared of the present stock of Silesian zinc, which has been purchased at still lower prices, and will again require a new supply, it must pay higher prices, for nobody here will think of consigning spelter to England under present circumstances, and there will then be no other way than to buy it and to pay the prices obtainable for it here. The production of spelter has been (1871) about 50,000 cwts. less than in 1870; this year it will be less again. The calamine is getting of inferior quality, coals are dearer, workmen's wages have been increased since January, a great demand is springing up from France and Austria, and, for instance, Vienna requires 15,000 cwts. for the Exhibition building.

Breslau, Feb. 7. CORRESPONDENT.

REMARKS ON THE ORIGIN AND FORMATION OF METALLIFEROUS VEINS.

SIR,—In proportion as the igneous theory of the formation of metalliferous veins is investigated objections to it will suggest themselves in all directions. I have previously stated that the law of gravitation is of itself sufficient to account for a much greater density than that assigned to the earth. And I now add that the force of specific gravity must have played an important part, and have been everywhere active, during the formation of minerals by igneous agency; and the effects of this law ought everywhere to be met with, prominent amongst which would be an improvement in the quality of the ores in depth, arising from their greater specific gravity. Both these conditions would be accelerated by heat, which must always increase in descending towards the centre, or source, of terrestrial heat; and as a superior density is an attribute of metals, the heavier, in subsiding by change of temperature from their fluid suspension, must always form the lowest stratum—or, in other words, descend to the lowest available positions; but that such is not the case our mines afford sufficient evidence.

It is difficult to see by what arrangement the water could have been excluded from the fissures during the time they are alleged to have been filled by the depositions of substances condensed from igneous vapours and gases; and if it cannot be shown that such was the case the theory cannot be sustained, as gases ascending through water could not be the vehicle of any grosser substances; nor would the vapours arising from water itself admit of such conduction, as the temperature at which water becomes steam is much lower than that at which any of the metals of commerce are volatilised, and hence, instead of being a medium for transmitting the mineral and metallic substances, it would more nearly resemble a filter, and at once extract and condense them, and the result would be one of two things,—it would either form a mass in the bottom part of the fissure, which by becoming solid would soon be too dense for ebullition, and in that condition would soon effectually obstruct all egress and block up the channel: or else the condensed substances, by force of their greater specific gravity, would descend into the molten abyss, to become again the sport of its embracing and decomposing power, and thus the columns of water filling the fissures might be considered only as so many safety-valves, maintaining the equilibrium and indicating approximately the pressure of the imponderable forces acting from within and upon the crust of the earth.

Another theory essaying to account for the formation of true fissure veins is that the fissures were first formed by some great convulsion of nature. The dynamic forces, acting from indefinite depths, rent the earth's crust, and formed the fissures, as we now find them. That into these fissures the percolating waters descended, charged with the several ingredients held in solution. Their deposition, or precipitation, from this state of solvency immediately took place, and continued until the respective fissures were filled with matters which were wrought by chemical and mechanical agencies into minerals—simply considered as such—and mineralised substances, metallic minerals, or, in other words, the ores of commerce and all other ores; and that the deposition of the minerals and the mineralised substances took place according to the laws of affinity. This theory also recognises periodical enlargement of some of the fissures by the same disruptive agency. This idea appears to have been suggested by the comby structure of the minerals found in them, and the number of combs in any individual vein is presumed to denote the number of times it has been enlarged. I readily endorse that part of this theory which alleges the filling process of the fissures to be by infiltration from congenial country rocks, whether contiguous or remote, but to the mode of their production I hesitate not to take the most unqualified exception; neither can I see that any evidence exists for the distinction which has been made between what are denominated respectively "true fissure," "gash," and "segregated" veins, since no evidence, internal or otherwise, can anywhere be found that the origin of metalliferous fissures of all denominations, and the filling thereof, are not due to the same agencies, and are the product of one invariable process, modified only according to its detail and progress. Viewing the subject in this light, I can only come to the conclusion that such distinctions are merely fanciful and arbitrary, not having any foundation in or support from observed facts.

Gash veins are alleged to have originated in fissures formed by contraction of the rocks during their passage from a plastic to an indurated state by their loss of the liquifying and expanding agents, whether such agents were aqueous or calorific, or both. But if this view be submitted to analogy, and determined by that standard, nothing could appear more improbable, since the line or strike of such fissures must thus have been subject to no law, and would have occurred in all conceivable directions, according to circumstances purely local and accidental, affected only by affinity, pressure, and gravitation. The depths of such fissures must, then, have depended on whether the aqueous or the calorific agency preponderated. If the former, the contraction of the nascent rocks by its evaporation must have been greatest at the surface, and declining in depth inversely to the square of the depth from the surface. There is no evading such a conclusion as this, since the intensity of both light and heat is inversely to the square of the distance from their emanating sources; and the evaporation of water, in a greater or less degree, is affected by the intensity of heat to which it may be subjected, in a similar manner and to a similar extent, and also by atmospheric influences. Under such considerations as the foregoing, and subject to laws of Nature which are demonstrably unvarying and constant in their action, the conclusion must be arrived at that the depths of all metalliferous fissures must be in proportion to their width at the surface, provided that all other things were equal, including a uniform quantity of water everywhere pervading the material about to be consolidated into solid rock—that is to say, if at the depth of 100 ft. a fissure were found to be 6 ft. in width it would at 200 ft. be only 1 ft. 6 in., and at 300 ft., according to the law, it would gradually decline to 8 in., and so on proportionately until it absolutely terminated. But if heat predominated as the expanding agent in the incipient stages of rock and vein formation, then the fissures might be supposed to extend deeper, as the radiation of heat from the surface of the solid earth is more uniform and extensive than the evaporation of water from the same area, inasmuch as there are large tracts of rocky surface exposed to atmospheric influences which contain but little water, or covering of either soil or subsoil. These are conditions which admit of the radiations of heat freely, and with almost invariable constancy, not only superficially, but extending to very great depths, as in such situations the igneous rocks abound, and consequently would admit of contraction by the loss of heat to a much greater degree than could possibly take place in the same space of time from the evaporation of water under all circumstances.

The filling of the fissures said to be found in this way is alleged to be by infiltration, and the mass thus accumulated subjected to chemical action extending indefinitely through the space of untold ages. Why such a period should be assigned to Nature in the production of metalliferous minerals it is difficult to conjecture, especially when we know that the lapidifying process goes on much more rapidly in other departments of the same domain. For instance, the formation of travertin, like stalactites and stalagmites, is constantly going on; particle after particle is being added to the general mass by a seemingly endless lapidifying and crystallising process from gradual depositions. Other rocks are being gradually built up, and each successive day witnesses the perfection of that which has preceded it. The coral reefs, for instance: the foundation is coral, and the superstructure is coral, so far as raised, and every individual atom added thereto as soon as incorporated becomes coral, and no subsequent chemical change revolutionising the whole aggregated mass is necessary to perfect the process.

That the filling of the fissures is gradual, and extends over comparatively lengthy and indefinite periods of time, is perfectly consonant with the dictates of reason and the evidence of natural facts, as well as with experimental investigations. But that the elaboration of the contents of the fissures into ordinary and metallic minerals requires indefinite ages to be perfected is opposed by both natural and experimental facts, since the most perfect counterpart of ores and their associate gangue can be artificially produced, subject to electric action, without even the aid of a voltaic battery, in from two to three weeks; and Mr. R. W. Fox's beautiful experiment shows with sufficient clearness that metallic and other minerals, being reduced to an impalpable powder, and indiscriminately mixed together, and wrought into a paste by the addition of water, instantaneously arrange themselves according to their several affinities, as found in nature, under the simple action of voltaic electricity. And it is well known that a few months only are necessary for the production of stratified rock as an incrustation of steam-boilers, and large crystals are sometimes formed in this way in a comparatively short space of time. I have seen perfectly bevelled crystals of sulphate of barytes, of more than two square inches superfices, taken from steam-boilers, and scores of such at a time in pieces, or plates, of about ¾ inch in thickness, and from 2 to 3 ft. square.

Man sometimes stumbles upon a discovery by accident, but this is owing to the blindness and unsusceptibility of his faculties, from the stupour of which he occasionally awakes to the observation of a new light, which he hails, and, possessing energy, follows, and it guides him to the realisation of a new truth, which Leibig, I think, has said is equivalent to a new sense, and no one, I am convinced, of even ordinary intelligence can doubt the propriety of such a simile, since every new fundamental truth discovered by the mind must, when duly appreciated, stand related thereto as a new faculty, being in and of itself a lever, or instrument of power. But Nature is not so blind and limited as man is to the discovery of truth, by progressive steps, through various instrumentalities, and can never be libelled with having accomplished more by accident than by design, but rather that she sees the end from the beginning, and comprehends all intermediate events.

Gash veins are further considered to terminate with the strata in which they are formed, and are not merely affected by a change thereof, but entirely precluded from further continuance. I need scarcely say that such a notion as this is decidedly fanciful, as it is well known to many practical miners that the main lodes—"true fissure veins"—of many districts are similarly affected under similar conditions.

It remains now to notice the class of veins inappropriately distinguished by the prefix "segregated," and to offer some remarks on what appears to me as the only tenable process of fissure and vein formations. My next letter will be in respect of these objects.

Ellsworth, Nye County, Nevada, Jan. 10. ROBERT KNAPP.

"WHAT TO SELECT—WHAT TO AVOID"—No. XII.

SIR,—The uneasiness and uncertainty induced by the American difficulty has caused investors and speculators to restrict their operations to the narrowest possible limits. In the consequent depression mining has more than ordinarily participated, by reason of the knowledge that in the event of any serious complications, which there is good reason to believe need not be apprehended, the value of metals would inevitably decline, more especially tin, America being one of our most important consumers of that metal.

The depression, however, has been more marked in the shares of American mines, the whole of which have been alike adversely affected, irrespectively altogether of the advices to hand from the different properties.

For the moment attention is being chiefly directed to sound dividend and progressive lead mines, the shares in many of which at current quotations should be purchased without delay, offering, as they do, large margins for important marketable advance on account of the encouraging manner in which their resources are being developed, and the improving condition of the lead market. Among sound dividend-paying lead mines I would point to Van, Tankerville, and Roman Gravels; among progressive lead mines, Pennerley and West Tankerville.

PENNERLEY.—This mine is opening out in a manner that insures its successful competition at no distant day with its adjoining neighbour, Tankerville. Its returns are now 75 tons of lead per month, and will shortly be increased to 100 tons, an eminent authority in the district having recently stated that from 125 to 150 tons per month could be legitimately returned from the mine in its present state of development. These shares are, without doubt, the cheapest in the market, considering the present returns, and the many important points to be attained during the next few months. It may not be generally known that many years since, before the whole of this important series of mines (including Snailbeach, Tankerville, Roman Gravels, West Tankerville, Pennerley, and Bog) were suspended, Pennerley from only one of its lodes returned as much as 60 and 80 tons of lead ore per month, lead at that time being of considerably less value than it is now. About twelve years ago a new shaft was commenced in the east end of the sett, under the superintendence of Capt. Arthur Waters, and after sinking from surface to the boat level, 50 fathoms, a lode worth 15 tons of lead ore per fathom was discovered, which led to the erection of powerful machinery, and extensive general plant for the re-opening of the mine. Capt. Waters expressed an opinion long since, which is now being verified by results, that every mine in the district which had a full and miner-like development has turned out a rich prize to the shareholders. Since the present company took possession of the mine active underground operations have been prosecuted, resulting in most important discoveries on Warm Water lode, which is parallel to Big Ore lode, on which up to that period the chief

ons of the company had been conducted. The 40 and 60 fathom ls, on this lode, have opened up large reserves, and during the week, in driving from a point where the same lode was intersected by a cross lode in the 80, a valuable lode has been driven into, ough the end is a great distance behind the reserves in the 40 60. The importance of these side lodes to the permanent success of the company cannot be over estimated, since they may be intersected at every level to the bottom of the mine (the 130). It is only the Warm Water lode that remains to be developed, for there at least three or four other parallel known lodes yet to be laid n by cross-cuts.

The inadequate means of the former company alone prevented these ortant explorations being carried out, which have been so vigorously undertaken by the present company, and yielding such satisfactory results.

WEST TANKERVILLE.—The improving condition of this mine, ich I have from time to time indicated, is fully borne out by the cial report. I am more than ever satisfied that these shares should purchased without delay. FREDK. WM. MANSELL.

, *Pinner's-court, Old Broad-street, E.C.*

THE MINERS' WAGES QUESTION.

SIR,—The letter in the Supplement to the Journal of Saturday last the Miners' Wages Question, signed "Viator," I am fully satisfied es a brief, though faithful, portrayal of the whole question. From long experience, I am satisfied the four-weeks system will age the interest of the miner, and that at the end of the year he net less money in 13 pays than he now gets in 12. MINER.

Penzance, Feb. 12.

PRACTICAL MINING—TIN DRESSING.

SIR,—During a recent visit to Cornwall, on going over the dressing-rs of the principal tin mines, one cannot help being struck with absence of scientific skill, energy, and economy being brought to r in a greater degree on this branch of mining. After spending immense amount of capital in opening mines, the produce is ught to the surface, passed as quickly as possible through stamps buddle, the crop tin removed, but the slime ore, to a great ex-, cast into the river for the benefit of those below.

A scientific system of classification direct from the stamps or crusher alone remedy and remove existing evils; the different sizes also ried direct to the buddles and other machinery employed. Bor-'s buddle, I think, does its work the best of either one I have n, but even this is not what we have a right to expect from our dressers and engineers. Probably the ore dresser being considered inferior kind of being to other mine agents may have tended to p back improvements in this direction.

There never was greater need than now for someone to come for-rd, place this matter in the true light before our mining men, and them act accordingly. I am hoping the experiment now being de at Dolcoath by Capt. Boyns will prove successful, feeling sure m what I saw that this is a great movement in the right direction. An interesting discussion followed my last communication, and I hope that this humble effort will lead to a thorough examina-n of the subject now under notice. JOHN SPRAGUE.

Nursery-street, Pendleton, Manchester, Feb. 15.

EBERHARDT, UTAH, AND SOUTH AURORA MINES.

SIR,—In the Supplement to the Journal of February 10 is a letter itten by an "Investor in American Mines," about the Pinto and hite Pine Silver Mines in general, in which he says—"No sane man London would now venture one shilling in the once much-vaunted hite Pine pockets." Will you, in reply, permit me to say that I e been a worker in as well as a proprietor of American mines, have recently become an "Investor" in them? From my expe-nce, then, I am led to believe that the "White Pine pockets" will well enough after they get two or three months fine weather, get their mills and furnaces in proper working order, plenty of fuel water, and, above all, competent and trustworthy managers. art from this, if the "bulls" and "bears" would divert their at-tion to some other properties that "no sane man in London would est one shilling in," I feel confident that South Aurora, Utah, Eberhardt shares would to-day stand at a premium.

We all know that a mine cannot be made a permanently paying estment so soon as the first sod is turned, even in England or les, where every modern mechanical appliance is readily at hand thoroughly and quickly develope the resources of a mine. How ch more so, then, does this apply to such distant mines as Eber-rdt, Utah, and South Aurora, where so many unforeseen difficulties ve had to be contended with (but which, I believe, are now all mounted), such as severe storms, obtaining machinery, fuel, &c. England or Wales a new mine is called *progressive* for many years er being opened. In the White Pine district a mine is required by ne to be dividend-paying as soon as operations are commenced, ich is simply unreasonable.

I have never before rushed into print, but have long watched the usions of many who have written about the Nevada, Californian, d Colorado mines, and from my experience in mining I am satis-d that many do so who could not tell you the difference between rue fissure vein, a pocket, ledge, or lode, and have never seen a ne. I feel confident, therefore, that if the "bulls," and "bears," d letter writers will only leave those worthless White Pine pockets the care of their respective managers and directors for (say) six onths longer, the shareholders will not regret their holdings, for y must not forget that the latest reports (all official) are of an couraging character, so much so that I (even in the face of that ter from "An Investor in American Mines") intend to increase y holdings, and at the same time will back my sanity against his, d still remain A BELIEVER IN WHITE PINE POCKETS.

Feb. 13.

SECRETARIAL MINING.

SIR,—Will you permit me to call your attention to the jobbing Secretaries. I ently received a circular from one of these gentlemen advising me, as a "valued reholder," to increase my interest, the secretary knowing "he was doing the ht thing at the right time in recommending me to buy." A lady friend of ne listened to this counsel; the shares were delivered out of the secretary's ne and bought of him. I sold some of my shares, and the secretary's name s passed for them.

Is it, Sir, a consistent position for a secretary to act as broker or jobber?—In er words, trafficking in the shares of the company from whom he receives a ary for the performance of certain duties, which most certainly cannot be charged in the "market place," although this comparatively new generation st certainly do not stand there "all the day idle."

Old-fashioned people, like myself, were wont to consider a jobbing secretary as ervant totally unfit for the important position he filled; and it is the first ty of the directors, as the shareholders' trustees, to "keep their house in or-," and so control their subordinates as to prevent the continuance of this dern evil, the perpetration of which must surely bring discredit upon mining, d engender dissatisfaction among the shareholders.

I enclose a copy of the circular above referred to, and also my card.

Feb. 13. A SHAREHOLDER.

P.S.—I have designedly omitted the name of the mine alluded to, as it is only principle which should be stamped out.

GAWTON MINE.

SIR,—The price of shares of this mine last month was 6*l*. 10*s*. to 7*l*. Can any sonable individual reply satisfactorily to this letter, and say why the pre-t quotation is as low as 5*l*. 15*s*. to 6*l*.? A word of truth is worth a great ny folios of mining puffing. The office in which Gawton is managed is so hly respectable that it has never ventured upon such means of running up shares. The reports are most satisfactory, and as I never wilfully puff any ne (for I simply defend a good one from detrimental attacks to depress it), I in ask, Why is Gawton lower than last month? Last week's Journal stated ithout denial) that the tutwork points in operation were worth 53 tons of per ore per fathom, and that the 70 indicates a change! The junction of el Tor tin lode both dropping down gradually and diagonally towards the vancing end of the 82, must be cut in driving 3 or 4 more fathoms; and all ac-inted with the mine will tell you that there lies a mass of tin and copper ich will pay off the mine at once if quoted at 6*l*., or 24,000*l*., for the present ce. I hold highly the opinion of the miner at the district—the native. Ask n his opinion, and he will set the mind of the most sceptical at rest. If I se a bouquet of mines for the future rise I should place Gawton in it as the tre flower—the choicest of all. The timid might say, "Ah! the Tamar river l overflow and fill your mine." It has overflown, but each time it leaves a osit which becomes impervious to wet nothing can pass through it.

The last sampling was 294 tons of A 1 copper ore; it pays 5*s*. dividends, and l pay more, and has but 3950 shares. In a week or two the 82 fathom level l testify to the real worth of Gawton. The copper is valued at 80*l*. per hom; the winze in the 70 is showing wonders, so much so that great expecta-ns of an enormous discovery may now be daily expected. This mine has been ked in a very scientific manner, and the results, I am glad to see, will shorty satisfy all, and reward the most patient shareholder, far more indeed than he ever expected. Gawton Mine is a prize which will be, ere this day twelvemonth, one of the great copper mines in England, paying at least the largest dividends for money-value of the mine, with a few exceptions. VERAX.

Feb. 13.

MINERA UNION MINE.

SIR,—Public attention being now so much directed to lead mines, I think a word or two on this property would not be out of place. This mine is situate in the Minera district, adjoining, and has communications with, the celebrated Minera Mine. The drainage is by levels, and no machinery is used for that purpose; the sett is large, and royalty reasonable. At present regular returns of lead are made, but scarcely sufficient to meet the working expenses. From trials now being made valuable discoveries are looked for, which will soon place the mine in the Dividend List. The perseverance of the directors and shareholders will, no doubt, shortly enable them to realise what they have so long merited—that is, judging from the nature of the developments and position of the mine. Why its shares are so little enquired after I cannot think, but I hope this will stimulate speculators to make enquires and look to this valuable property. H. P.

VAN CONSOLS MINE.

SIR,—You stated in your City Article last week that the lead recently found in Van Consols is situated *between* the deposit found when the mine was worked as Bryntail and the deposit in Van, but you did not mention that there is something else situated *between* Van Consols and Van—an abandoned mine, and abandoned because the ore cut out. In other words, because that actually took place which the secretary last week regarded as an absurdity to suppose possible.

The truth is that between Van and Van Consols an entire change of ground takes place, bands of gritstone disturbing the regular ore-forming rock; the inference, therefore, is that the only chance of finding a continuous deposit is at a depth below the influence of these disturbing causes. It would be interesting to know to what depth they are likely to extend. OBSERVER.

Feb. 13.

GREAT NORTH LAXEY MINE.

TO THE SHAREHOLDERS,—I wish to call your attention to a statement I saw in the *Mining Journal* a few months ago, and that was that Capt. Arthur Waters had inspected the mine, and reported that there were reserves of ore of the value of 30,000*l*.—he could not have made that statement unless he had seen them. Now, does it really exist? If it does, why do we not see some account of sales, as from other mines? I believe that there are many 30,000*l*. worth of ore in the mine if the man gers would fetch it out, but perhaps about the year 1899 they may begin to bring it to light. After years of stoping, cross-cutting, &c., they reached to the depth of 110 fathoms; that, I fancy, is getting near to paying ground. When they got there they might have thought, or some kind friend might have suggested, that they had better not go any lower at present, as they would not be able to give the shareholders 50 per cent. out of one shaft—they had better sink another. At any rate, after years of the same process as above, another shaft has been sunk, and I saw by the report in last Saturday's Journal to 110 fms.; and I also saw in the same report that they are thinking of sinking the north shaft below the 110. They may alter their mind and sink another, so as, doubtless, to give a good rattling dividend (when they do give one) of 75 or 100 per cent.—*Feb.* 14. AN OLD SHAREHOLDER.

ST. JOHN DEL REY.

SIR,—The letter which appeared in your contemporary, the *Money Market Review*, must have emanated from one much more sanguine than myself. As shareholders, we must not forget that the new shafts have to be sunk 100 fms. (50 fms. each), which will no doubt cost at least fully as much as has already been incurred. When the shafts shall have reached the necessary depth a considerable length of time must elapse in opening out stoping ground—at least two or three years.

My difficulty is to be assured that with the debenture stock already issued, the only security for which is the uncalled capital, we have funds sufficient to complete this heavy work. Mr. Gordon and Mr. Sopwith led us to believe that the reserve fund would have been sufficient, but we find that long before the work has been nearly one-half finished, both in point of time and outlay, the reserve fund has gone, added to which there is the serious additional drawback of the unexpected influx of water.

As Mr. Gordon is not a practical miner, and as the sinking of these two vertical shafts were commenced under the advice of Mr. Sopwith, whose estimated expenditure has already been very materially exceeded, is it not time that our executive sought the aid of some practical master mind to co-operate with those at present in charge of the mine?

There are many vital points upon which those shareholders who have any knowledge whatever of the subject are very anxious to be informed. Not the least important is—are these new shafts being sunk in the right position, rumours being very current that such is not the case? Another point is—what time will be occupied in sinking each of the new shafts (say) 50 fms., and when completed what will be the time and cost in opening out ground to make returns, and what are the probabilities of the present available pumping power proving equal to the additional requirements brought about by the unfortunate increase of water? Upon these points I am most anxious for information.

Feb. 13. AN ANXIOUS SHAREHOLDRE.

[For remainder of Original Correspondence see to-day's Journal.]

PUDDLING BY MACHINERY.

An improved furnace for machine puddling has recently been set to work at the West Hartlepool Ironworks, and is giving most assuring results—puddling and dividing the charge into balls with the greatest facility. The quality of the iron produced is all that could be desired, and the quantity turned out per heat is from 6 cwts. upwards, the time occupied being from 25 to 30 minutes. The invention, which is due to Mr. A. SPENCER, manager for Messrs. T. Richardson and Son, relates principally to the construction of the interior and the material used for lining. He constructs the interior of revolving puddling furnaces in such a manner that it shall present various flat surfaces for securing the more effectual disturbance and agitation of the liquid metal. The lining is poured in in a molten state from the outside; and the sides of the furnace are honeycombed, or opened to the outside, for more effectually holding the lining. The sides or surfaces of revolving polygonal furnaces of the character just described are lines with oxide of iron, which has been run into moulds of such a shape that the resulting mass when cold shall fit the sides. And, lastly, he employs mill-furnace cinder, or ball-furnace tap, as the special material for lining or fettling.

The improved furnace is built up of flanged plates bolted together into a rhomboidal or other appoved form, skeleton trays or boxes (in the form of bars or otherwise), after being filled with the lining in a molten state, or as otherwise herein stated, being sometimes substituted for the side plates, which are intended to be bolted at their ends to the end plates of the furnace. The improved process of lining by pouring in the molten material will be better understood by contrasting it with the process commonly employed for lining the bottom plates of ordinary puddling furnaces—viz., placing a quantity of wrought-iron scrap on the said plates (which are plain), then urging the fire to melt as much as possible of the scrap into an oxide of iron, allowing the oxide to settle down on to the bottom plates, and thus to form the lining, from which any unmelted scrap is carefully removed. The sides, ends, and roof are not thus lined, but bricks or other well-known materials are employed. A revolving furnace cannot be lined in accordance with this process, as the top and sides would melt down before the wrought-iron scrap would be melted on the bottom. Now, by Mr. Spencer's invention this difficulty is obviated by melting down the oxide in a cupola, reverberatory, or air-furnace, and while in the molten state running it into the revolving furnace to fettle the interior, and allowing it to set upon either side or end as may for the time be necessary, and accordingly as such side or end, firstly one then another, and so on in succession, is presented for the purpose. The improved cellular, or other than plain character of the sides or surfaces, is to be produced by casting, or otherwise forming them with the dovetailed, honeycombed, or undercut cavities, sinkings, or grooves to be employed to key in or hold the fettling or lining. The lining is sometimes to be applied by pouring in as above described, and sometimes by previously moulding to fit the side or other plates, trays, boxes, bars, or parts. In the improved revolving convertor the fire-grate is similar in construction to the ordinary fire-grates of puddling furnaces, and provided as usual with pipe or culvert for introducing blast when required. The bridge end of the grate terminates in a cylindrical orifice opening into the convertor. The chimney or stack has also a cylindrical neck or throat leading out of or away from the convertor. Near the bottom of the stack is a door, with spy-hole for observing the operation of conversion. The interior of the improved revolving convertor has four sides or surfaces, arranged in the form of a regular square, and has also two ends. Instead of a square, however, a figure of three or more sides may be substituted, and the figure need not of necessity be a regular figure. And although the rhomboidal or skew disposition of the sides with relation to the longitudinal axis of rotation is preferred, this disposition, excepting in combination with the form or forms otherwise described, does not constitute a feature of the invention.

The construction of the convertor may be thus described: It is a box-like vessel, with circular openings in its ends, corresponding and communicating with the circular openings from the fire grate and into the stack respectively. The ends are circular vertical plates of cast-iron, with rims, flanges, and ribs, &c., thereon, and the circular openings are cast or formed in the said ends. The outer flanges or rims of the ends enable them to be supported by and to rest and revolve upon the rollers of the roller carriage, which, by means of its wheels, is free to be easily moved upon the rail plates, and with the convertor thereon bodily conveyed away from the normal position of the carriage and convertor, for the purpose of fettling or repairs when required; large spur wheels secured to the end plates are provided for giving the revolving motion to the convertor from pinions from any convenient gearing, and which may be driven from a steam-engine or otherwise. The surfaces of the plates within the body of the convertor are cast with dovetailed honeycombings or cells for holding the fettling. The sides of the convertor consist of skeleton cells, trays, or boxes lined with fettling and bolted to the ends. On two opposite sides of the convertor are hinged honeycombed doors, having in them charging holes and spy holes, and which (doors) may be opened singly or together for the purpose of withdrawing the charge. The trays, when trays are used, after being filled in the moulds and allowed to cool are secured by bolting to the ends of the convertor. Honeycombed plates may be substituted in place of the trays, and instead of the cells, cavities, sinkings, or grooves being produced by casting, as described, they may be produced by cutting into the body of the plate or by affixing pieces thereto. The end plates of the convertor are to be fettled by means of bricks made of the same fettling material, cast in suitable moulds of a wedge or key-like form, so as to fit and lock into the ends. And further to secure the whole of these bricks molten fettling is to be run in behind them, filling the dovetailed cells in the said ends, laying hold of the bricks and solidifying the whole firmly together. The "mill-furnace cinder" or "ball-furnace tap" above mentioned, which are considered to be materials specially suitable to be used as and for the purpose of the fettling or lining when applied in combination with or in pursuance of any of the improvements mentioned, are well-known oxides of iron, being the waste cinder or meltings of wrought-iron when subjected to the heat of a reverberatory or other furnace, care being taken that the bottom of such furnace upon which such wrought-iron is placed shall be made of cast-iron plates, lined as customary, and avoiding all siliceous matter.

The mode of using the improved furnaces, though nor constituting a part of the invention, may be briefly appended. The iron to be heated is to be introduced into the convertor in a molten state, the charging holes to be closed, and the convertor to be revolved, when by means of flat sides the iron will be thoroughly agitated, and after the required time, which may be ascertained through the spy hole, it will assume the granular form, and commence to ball. The doors are then to be opened, and the ball or balls withdrawn and conveyed to the hammer.

CAPT. W. TREGAY'S IMPROVED ARRANGEMENT FOR THE DISCHARGE OF STAMPED ORES.

It has often been remarked by those who have charge of stamping machinery, especially when the softer kinds of ore are under treatment, that with a moderate supply of water there is more difficulty in getting the stamped ore through the grate than in reducing it to the necessary degree of fineness. It is evident that so much of the already reduced ore as is driven against the sides and angles of the ordinary "coffer" will fall back under the stamper, and reduce the efficiency of the next blow. At the same time this material, which is already fine enough, gets reduced still more, and so the quantity of slime produced is unnecessarily great. Capt. Tregay's improved arrangement admits of the grate surface being more than doubled, the result of which is an equal, or nearly equal, increase in the quantity of stuff stamped. It may be seen in operation at Pedn-an-drea Mine, near Redruth. The following description and its accompanying illustrations will clearly explain the whole improvement.

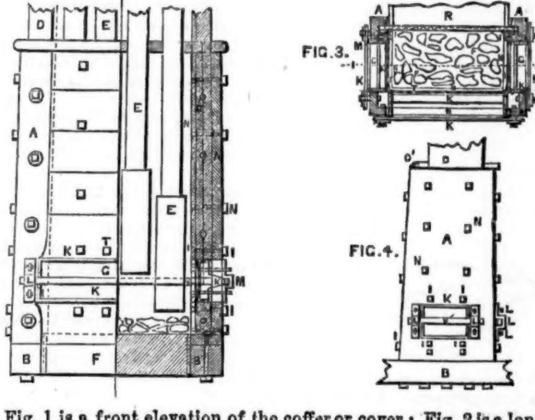


Fig. 1 is a front elevation of the coffer or cover; Fig. 2 is a longitudinal section of the same, taken on the line I-I of Fig. 3.

Fig. 3 is a section of the coffer taken horizontally through the grate-way on the line 2-2 of Fig. 2. Fig. 4 is an end elevation of the coffer. Similar letters of reference indicate the same parts in all the figures.

A is the frame of the coffer, constructed preferably of cast-iron. Each stanchion, A, is cast with a flange at bottom, by which it is firmly bolted to the wooden sleepers, B. C is the coffer in which the ores are pulverised by the stamps, E. To the stanchions, A, are bolted the oak posts or standards, D, which support the framework or upper part of the apparatus. E are the stamps with their lifters, which may be raised by cams as usual, or in any other suitable manner; F is an iron bottom or bed on which rest the substances to be broken.

The stanchions, A, have an opening, G, a similar opening being provided on either side of the coffer, so as to afford a clear grate-way or discharge way on all sides unobstructed by the framework, as has been the case hitherto, thereby permitting a freer egress of the pulverised substances. The stanchions, A, are formed with angle pieces at the corners of the coffer, to which the boards forming the front of the coffer are bolted. H is the grate. It consists of a perforated sheet of metal extending round the interior to the coffer on every side where the grate way is situate. In the figures this sheet of metal is shown on three sides of the coffer, the opening at which the coffer is charged being situated on the fourth side, but the discharge might be easily arranged for the fourth side also. The angles of the stanchions, A, stand off from the angles of the grate, the entire surface of which is, therefore, utilised, not being partially blocked up by the framework of the coffer as hitherto. I is a metal lining or frame bolted on the inside of the coffer around each opening, G, by bolts, I', passing through the stanchions A. The grate, H, is clamped firmly against this lining, I, by a frame, K, placed within the opening or discharge way, and having projecting lugs on the back by which the frame is pressed against the grate, and secured by a cross-bar, K', passing through the staples, L, and pressed home by wedges, M. N is a rim or packing of some yielding substance, such as india-rubber or flannel, bound round a rim of iron compressed between the frame, I, and the edge of the grate plate, for which it serves as a caulking to prevent leakage around the grate. L' are bolts to secure the staples, L, to the stanchions A. The said bolts may also support one end I'' of the end grate plates or linings, I, and for this purpose their inner ends are countersunk so as to be flush with the inner surface of the plate I. N' are metal plates secured by bolts N'', with which the interior of the coffer is lined as usual; and O is an iron shutter sliding in grooves in the framework of the coffer, and serving to regulate the supply of the substance to be broken. It is supported by the angle iron, O', resting on the top of the foot piece A. P, P, are wood blocks with which the back angles may be filled when the grate is made to end there instead of being carried quite around the coffer. This is sometimes done in order to open a broad aperture, R, for charging at the level of the grate hole, which would otherwise have to be done above that level. In the latter case the grate, H, would be carried round all four sides of the coffer clear of the rear angles. In this case a clamping device would be applied to the rear opening to hold the grate the same as for the other openings. In the coffer shown

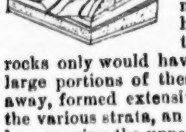
the material to be pulverised is fed in through the aperture, B, Fig. 3, by a pass leading from the hopper containing the supply, the amount of opening being regulated in the usual manner by the shutter O.

Like almost all other real improvements, this one is very obvious, and it cannot fail to place many pounds in the pockets of the adventurers of the mines in which it may be adopted.

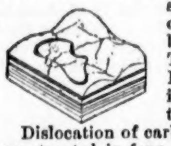
MECHANICAL REPRESENTATION OF GEOLOGICAL PHENOMENA.

It is now so generally admitted that success in the development of industrial undertakings is almost entirely dependent upon the judgment and sound technical knowledge possessed by those entrusted with the management of them that, by all connected with mining enterprise in stratified formations, the value of "Sopwith's Models" should be more generally recognised than ever. The inventor of this very ingenious method of mechanically representing geological phenomena is Mr. THOMAS SOPWITH, M.A., F.R.S., who for many years managed the extensive lead mines of Mr. W. B. Beaumont, whence the celebrated W.B. lead is derived, and, although his models have been for more than a quarter of century before the public, improvements upon them have not even been attempted. In the Government Museum of Practical Geology, in Jermyn-street, are several models of mining districts, on a large scale, by Mr. Sopwith, which are well worthy of careful examination; but, in addition to these, there is a smaller set, which is even more interesting, from its adaptability to the purposes of instruction. The set embraces twelve models, and, as they are intended to explain several geological phenomena which have an important bearing on practical mining, and on the exploration of new districts containing valuable minerals, we subjoin diagrams of each.

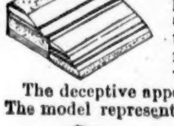
The first model, which is shown in the annexed diagram, illustrates the effects of denudation, and represents a square mass of carboniferous or mountain limestone of Alston Moor, in the county of Cumberland, on a scale of 100 ft. to an inch. The seams of coal lie in the same manner as the rest of the strata, and if these had remained unaltered in the position in which they were deposited it is obvious that the upper rocks only would have been known to us.* Denudation, by which large portions of these stratified rocks were subsequently washed away, formed extensive valleys which afford convenient access to the various strata, an advantage which will be at once understood by removing the upper part of the model.



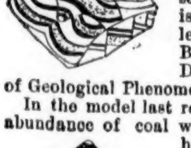
Next we are shown the coal strata near Newcastle-on-Tyne, on a scale of 10 chains or 220 yards to the inch. The undulation of the surface and the basset, or cropping out, of a seam of coal is the effect of denudation. Successive beds of coal are represented by laminæ of ebony. The underground workings are delineated on the Bensham seam, the depth of which at Wallsend is about 870 ft., or more than twice the height of the cross of St. Paul's Cathedral.



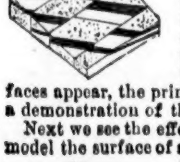
Dislocation of carboniferous strata is next explained by a model constructed in four parts, which may be separated, and thus exhibit—1st, the original position of strata; 2d, the shifting and vertical displacement; 3d, the appearance of the surface after the inequalities are removed. The line of displacement illustrates the nature of mineral veins, which are fissures in the strata, attended with more or less vertical movement of adjacent rocks.



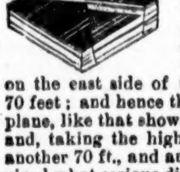
The deceptive appearances resulting from successive dislocations. The model represents calcareous, siliceous, and argillaceous strata, with thin seams of coal, which basset or crop several times on the surface, and present a fallacious idea of the strata beneath, for, though several beds of coal appear at the surface, there is no considerable quantity beneath. An excellent illustration of such faults is given in Mr. Buddle's section of Jarrow Colliery, inserted in De la Beche's "Sections and Views illustrative of Geological Phenomena."



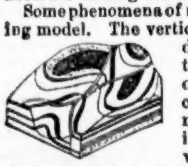
In the model last referred to, the surface presents an apparent abundance of coal where scarcely any exists below. We have here an example of dislocations of coal strata corresponding with the condition of most of the large collieries in the kingdom; no coal appears at the surface, although subject to considerable faults or dislocations below. A curious horizontal section is presented to view by removing the upper portion of the model; and, however singular the strata on some of the surfaces appear, the principle of construction of these models is at once a demonstration of their accuracy.



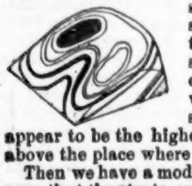
Next we see the effect of the intersection of mineral veins. In this model the surface of a dislocated seam of coal is shown by supposing the superincumbent strata to have been removed. The vein represented by white wood is the first-formed vein. It hades or inclines with the bottom to the east, and the strata on the east side are thrown down 40 feet. Subsequently a second vein has been formed, whence further dislocation ensued, by which the rocks on the east side of the newly-formed vein have been thrown up 70 feet; and hence the seam of coal which was originally a regular plane, like that shown in model No. 2, is separated into four parts, and, taking the highest portion for a datum, one part is 40 feet, another 70 ft., and another 110 ft. below it. It may readily be imagined what serious difficulties arise from these dislocations, and how important it is for the welfare of the country that a correct knowledge of them should be preserved. The instructive lessons which the vast mining operations of this country afford cannot be too carefully treasured, in order to avoid the waste of time and capital and the loss of life which may ensue from opening mines which have been partially worked—a danger which nothing but the preservation of accurate mining records can avert.



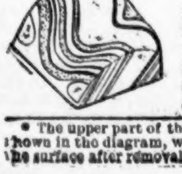
Some phenomena of mineral veins are well explained by the succeeding model. The vertical cliffs caused by displacement of the strata do not now exist, having been removed by extensive denudation. The intersection of veins on such a denuded surface is often an extremely complicated problem, of which the present model is an example. In one part of the model it may be seen that the mineral vein, nearly vertical, is scarcely to be distinguished from the horizontal strata, but the true relations are apparent on examining the edges of the model.



Overcut strata are next explained. If the strata had remained in the nearly horizontal position in which they were deposited, any subsequent grinding away of the surface of any stratum would have worn off the upper portion, and denuded first the upper, then the lower strata, which may in such case be said to be overcut, as shown in this model. In every case where the strata are overcut they form a V-like shape, pointing up the valley; the higher rocks appear to be the highest, and the seams of coal are to be worked above the place where they basset or crop out.

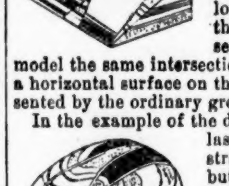


Then we have a model showing undercut strata. It frequently happens that the strata are inclined at a steeper angle with the horizon than the surface of the country, in which case they may be said to have been undercut by the process of denudation, as shown by this model. The V-like form of the strata now points down instead of up the valley, as in the preceding model. The highest rocks appear the lowest, and the coal is to be worked below where it crops out. These terms of overcut and undercut apply to plane surfaces as well as to valleys; but steeply undulating surfaces have been selected as affording the most striking illustration of these features, which are of general practical use in the observation of a mineral district.

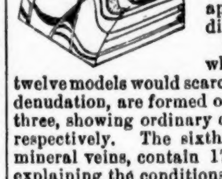


The models hitherto explained have been either cases of horizontal strata or of strata inclined in the same direction as that of the surface. In this model we have an instance of denuded basset of inclined strata; the strata here are inclined in the opposite direction to the descent of the valley, and in every such case they are undercut—hence the V-like form tends upwards. This and the two previous models form an epitome of the conditions under which stratified rocks are denuded, and of the characteristic marks by which their relative inclination, as regards the surface, may be ascertained.

The effect of the vertical intersection of mineral veins is next shown. The strata represented in this model are dislocated by four mineral veins, and the plane surfaces of the model afford a clear view of the geometrical relations of the several rocks. Two sides show the original horizontal deposition; the other two sides the subsequent disturbance or dislocations. On one of these may be observed the intersection of two veins on a vertical section. By removing the upper part of the model the same intersection is shown on the oblique plane, and again a horizontal surface on the base of the model, as it would be represented by the ordinary ground plan of a mine.



In the example of the denudation of mineral veins shown in the last model of the series, the conditions of the strata are the same as in the preceding model, but the denuded surface furnishes a view of the peculiar and frequently very perplexing appearance of such intersections of veins and disturbed strata.



The number of separate pieces of wood which enter into the composition of these twelve models would scarcely be anticipated. The first two, explaining denudation, are formed of 21 and 25 pieces respectively. The next three, showing ordinary dislocations, contain 27, 70, and 66 pieces respectively. The sixth and seventh, referring more directly to mineral veins, contain 17 and 73 pieces. The next three models, explaining the conditions under which stratified rocks are denuded, consist of 45, 22, and 17 pieces; and the remaining two, illustrating the vertical intersection of mineral veins and the denudation of mineral veins, contain 130 and 66 respectively—no less than 579 pieces entering into the composition of the twelve models.

The information afforded by this set is very complete, and it is understood that Mr. Sopwith is at present preparing a smaller series of six models representing the most important features, with somewhat less of minute detail, in order to place this system of study within the reach of all.

* The upper part of the model, which illustrates the unaltered strata, is not shown in the diagram, which, therefore, only represents the denuded aspect of the surface after removal of the superincumbent rocks.

"LODES"—"HEAVES"—"SLIDES."

The attempt which is being made by the Miners' Association of Cornwall and Devon to elicit information from the practical miner promises to bear good fruit. The following account of a district meeting at Illogan, on Friday, Jan. 26 (Capt. HOSKING, of East Pool Mine, in the chair), will be read with interest. We learn that other similar meetings are being organised.

Capt. JOHN MAYNARD, of East Pool, read a paper on "Lodes," "Heaves," and "Slides," of which the following is an abstract:—

The opinion of the "old school" was that our earth is now as it was when first created. To such persons the ideas of rocks of different ages is an absurdity. I must beg to differ from those who still hold such opinions—to me it is perfectly clear, speaking of our own neighbourhood, that the granite, the killas, the lodes, and the cross-cources, the elvans, and ironstones have been formed at different times. The same lodes are found cutting through granite, killas, and other kinds of rock, some crystalline, some evidently sedimentary; in some districts indeed—as at Crinnis—cutting through slates containing fossil remains of animals. The same thing may be said of elvan courses, which often cut through granite and slate alike.

There is abundant evidence of dislocation and shifting of the rocks in many parts of England; these dislocations are known as "faults,"—often great masses have been thrown upwards, or carried sideways, by some cause acting from the heated interior of the earth.

As to the origin of lodes and other veins a very few words may here suffice. They are, by many, supposed to be cracks or fissures, formed by the contraction of masses of rock cooling down from a high temperature, sometimes from a state of fusion; and afterwards filled up in different ways. The consideration of this part of the subject, and the different theories which have been put forth, would be of itself more than sufficient for one whole evening. Our subject this evening is chiefly to consider what we call "heaves" and "slides."

I believe that heaves are in all cases caused by one or more dislocations of the strata, extending over whole districts. The fissures so formed are called cross-courses, flookans, slides, breast heads, or caunter lodes, according to their size, direction, and the nature of the matter which fills them. When a lode is crossed by a caunter lode it is sometimes more and sometimes less productive than before, but there is in most cases a change in the lode. The intersections sometimes occur without altering the course of either the lode or the cross-vein, but generally one is found to be heaved to the right or to the left more or less. These things are generally noticed more by tributers than by any others. We have often, no doubt, been working our pitch in a productive lode, and thought we were doing well—after awhile we have met with a breast head, a cross vein, or joint less than a finger's thickness, when at once the ore is gone, and our spirit has quailed. We have sounded the rock on this side and on that,—sometimes we find the lode again, shifted about its own width to the right or to the left,—sometimes up and sometimes down,—at the time we have given up the pitch in despair. All miners know that such is the case, but the question is, how shall we know which way to drive to find the lode again? I believe that the key to the whole is to be found in a sinking of the ground on one side of the fissure, or its upheaval on the other by some force acting from below. This motion—taken in connection with the underlie of the lodes, will in the great majority of cases account thoroughly for the heaves, &c., which so frequently trouble the miner. As illustrative of my meaning, I beg to refer to the section of East Pool Mine, now on the wall. In this mine we have two lodes, one underlying north the other south. Generally when a cross-course heaves two lodes having a similar direction they are both heaved in the same direction. In this case they are heaved in different directions, one to the right the other to the left. If I am right in my opinion, the granite, killas, and lodes have since the formation of the lodes been fissured across, and the fissure having been afterwards filled in with quartz and other matter forms the cross-course. The ground on one side of this cross-course has sunk straight down, or that on the other side has been raised vertically, and such a motion of necessity has produced the unusual peculiarity of a right and left hand heave by the same cross-vein. Had the lodes been vertical they would not have been heaved at all, and we should have had no evidence of motion. If they had both underlied in the same direction both heaves would have been to the right or to the left, and we might have thought the motion horizontal, but having different underlies, the different heaves prove that the motion was vertical or nearly vertical; and this has, I believe, been generally the case. I think, then, that the proper way to learn how to drive when the lode is lost is to make ourselves acquainted with the direction and underlie of all the lodes and cross-veins in the neighbourhood, and especially with the heaves which may have occurred in neighbouring mines.

The paper was illustrated by many sections showing heaves, &c., in mines known to Capt. Maynard.

Capt. ROGERS, of Huel Uny, asked whether Capt. Maynard had ever known men capable of telling how far, and in which direction, to look for a heaved lode?

Capt. MAYNARD had known many—especially tributers—who would be right in nine cases out of ten; but such men were always naturally desirous of keeping such knowledge to themselves. The fact often remarked—that the extent of the heave was proportionate to the width of the cross-course—might be easily illustrated. (Capt. Maynard illustrated this statement by means of several very simple wooden models made in parts.)

Capt. HOSKING, of East Pool Mine, had known many tributers who would be able to say where to look for a lost lode, in most cases, in their own neighbourhood. One man, John George by name, was so well acquainted with the heaves in the neighbourhood of St. Agnes, that the cross-veins in one particular district were known as "Jan Georges."

After several remarks from Messrs. Josiah Rogers, — Trevethen, and George Terrill,

Mr. COLLINS observed that with such rocks as those in Cornwall, direct evidence of vertical motion was scarcely to be expected in many instances. In the colliery districts, however, where the rocks occurred in parallel layers or beds, the proofs of vertical motion were innumerable. He called attention to Mr. Henwood's valuable generalisation,* "the heaves of all lodes, by the same cross-vein, are in the same direction." To this rule there are but three exceptions in the whole 114 examples noted by Mr. Henwood up to the year 1843. The heave of East Pool, so simply accounted for by Capt. Maynard, would, of course, be such an exception. Mr. Henwood had also observed that "the extent of the heave was in direct proportion to the width of the cross-vein." Such considerations showed plainly the importance of an extended knowledge of the phenomena of the lodes and veins in whole districts.

* Transactions of the Royal Geological Society of Cornwall. Vol. v., 1843, p. 324.

IMPROVEMENTS IN STEAM-ENGINES.—The first part of the invention of Mr. GEORGE WEIR, of Marseilles, consists in applying an adjustable valve in the entrance to the condenser, and thereby causing an increase of pressure in the passage between the cylinder and condenser, or in a feed-heater forming part of such passage, and injecting into the feed-heater, or passage, the water due to condensation in the main condenser. By a second improvement chamber, or feed-heater, is arranged in connection with the cylinder, forming any part of the passage through to the main condenser, with passage leading to the feed-heater, is provided in the usual cylinder face, or in a separate port-face, and the main slide-valve, or a separate valve arranged to open the communication at suitable periods. There may be more such separate feed-heaters, arranged for different pressures.

AERIAL NAVIGATION.

The true question of aerial navigation is described by Mr. COURTEMANCHE, of Paris, to consist merely in the form or construction of an apparatus having power to elevate, lower, and direct itself in the air by a force which it derives from the air itself. This assertion, although not strictly in accordance with fact, is doubtless sufficiently accurate for anyone seeking with present appliances a mode of producing motion to overcome the obstacles to aerial navigation. Mr. Courtemanche proposes that his ship shall be propelled in motion by a steam-engine, which will actuate three screws, placed at the rear for propelling, the two others are placed below for elevating, and a rudder placed at the front. It has at the sides (two at the front and two behind) four inclined planes or wings which according to the requirements are either turned down or fixed to the sides, or raised and extended by means of a system of cords and pulleys, by men placed upon seats on a foot bridge situated below the vessel. The ship will also be provided with supports, placed two beneath the rear end and two below the front. This apparatus will about 160 feet long, exclusive of the rudder and the posterior screw. Its greatest width will be about 45 feet, and its greatest height including the foot bridge will be about 37 feet. These dimensions will be such that in all the transverse sections it will present an oval or egg shaped form. The fish-like form which is given it is that which is best adapted for cleaving the air without much effort, to rise easily, and to allow of advantageous working of the screws and rudder, and the wings and inclined planes. The greatest width of the vessel will be about two-thirds of its height, in order that the ascending screws may be in free air, so as to act effectively.

Were not the weight of materials the sole basis upon which the calculation as to the practicability or otherwise of any proposal for navigating the air can be made it would have been supposed that this important point had entirely occupied Mr. Courtemanche's observation, for he states that in the construction of his vessel two large pieces of timber will form keels, one below and one above, and one extending the whole length. These keels meet, and are joined together at the front and rear, and, consequently, form the outline of the vessel. From these keels wooden beams, forming stanchions, extend from the lower keel to the upper one. On the stanchions, upon a trellis, is stretched cloth coated with oil varnish, consequently at the same time that the apparatus possesses sufficient solidity to overcome the resistance of the air, it is also in two parts (there being left in the centre of the vessel an open space wherein the engine is placed), which by the employment here made of them will be of great utility, and at the same time of no great weight. The underneath part of the engine-room will be covered with cloth coated with oil varnish. It is advisable to cover this part in order to prevent the air from being drawn in, and thus endangering the equilibrium of the vessel, especially in ascending.

It is not distinctly stated what kind of engine Mr. Courtemanche proposes to use, but it is obvious that the selection of a suitable one will render it necessary to call in the aid of some of the largest manufacturers, as looking at the dimensions of the apparatus it will be seen that it must be of the same power as would be requisite to enable a vessel to steam against the wind with 400,000 square feet of canvas flying. The successful navigation of the machine will give general satisfaction.

PROGRESS OF DISCOVERIES IN ELECTRICITY.

SUPPLEMENT TO WATTS'S DICTIONARY.

The article on Analysis by Flame Reactions has been already referred to as giving a fair idea of the admirable and exhaustive manner in which several subjects are treated in Watts's Dictionary of Chemistry;* the article on Electricity may be cited as further evidence. The description of Holtz's electrical machine, with which the article commences, is excellent, a very large amount of information being furnished in less than three pages. Holtz's machine, it is explained, is a machine in which a very small initial charge is made to give rise to an indefinitely great quantity of electricity of high tension. Its action may be described in general terms as equivalent to that of an electrophorus and a condenser, combined together in such a way as to act upon each other alternately, the condenser being first charged by the electrophorus, then re-acting upon it so as to increase the charge of the cake; next being charged by the electrophorus to a higher degree, and re-acting upon it more strongly than before; and so on, the charge of each becoming greater and greater until the insulation is overcome. A very explicit drawing of the machine in the form usually constructed is given, and it is observed that it consists of a circular plate of thin and very flat glass, mounted on an insulating ebonite axle, so that it can rotate in a vertical plane; and a second glass plate, also as thin and flat as possible, is fixed parallel to it, with its centre in the same horizontal line, at a very short (⅛ in. or ¼ in.) distance from it. At the middle of the fixed plate there is a round hole, through which the axle of the movable plate passes without touching, and there are two deep notches or windows cut out at opposite ends of a diameter; at the back of the glass (that is at the side turned away from the rotating plate) a piece of paper about 2 in. broad is pasted along the lower edge of one of these openings, and a similar piece is pasted along the upper edge of the other opening, each of these pieces of paper having projecting from it a couple of tongues of stiff paper long enough to project through the opening, and just touch the movable plate; both the papers and their projecting tongue are well varnished.

On the side of the movable plate which is farthest away from the fixed plate and opposite to the two pieces of paper just mentioned, are two collectors, each consisting of a row of metal points projecting from an insulated metal arm, within a very small distance of the rotating plate. These collectors are connected with the main conductors of the machine, each of which is provided with a movable discharging rod, by means of which they can at will be placed in electrical connection with each other, or separated by any required interval. In order to put the machine in action the two conductors are connected together, the movable plate is set rotating at a moderate speed, and while it is moving an electrified body, such as a piece of ebonite excited by friction, or the cover of an electrophorus, is brought near to, or in contact with, one of the paper armatures. Both the papers then rapidly become strongly charged with opposite kinds of electricity; and if the knobs of the discharging rods are separated to a short distance a stream of sparks is seen to pass between them. These sparks become less frequent, but larger and brighter, if each of the conductors is connected with the inside coating of an insulated Leyden jar. The sparks also increase in size, but diminish in frequency, when the discharging knobs are moved further apart; but if the distance between them be made greater than a certain limit, depending chiefly upon the insulation of the different parts of the machine, the sparks cease to pass altogether, and unless the knobs be quickly brought nearer to each other the machine soon ceases to act.

Then follows an explanation of the action of the machine, and it is afterwards mentioned that besides the machine just described Holtz has constructed machines acting upon the same general principle, but differing considerably in arrangement; the construction has also been varied and simplified by Poggendorff, his most important alteration being the substitution of small holes just large enough to let the tongues of the paper armatures pass through for the large openings of Holtz's original form. Thomson's electrometers are next described, and then a section is given on new forms of galvanic batteries, embracing Walker's platinised carbon batteries, the bichromate of potassium battery, De la Rue and Müller's chloride of silver battery, Bunsen's sulphate of mercury battery, Leclanche's battery, Meidinger's battery, Thomson's battery, Siemens and Halske's battery. In subsequent section's Thomsons galvanometer, the several magneto-electric induction machines, the electric resistance of conductors, the standards of electrical resistance, the absolute measurement of electric resistance, and the comparative of electro-motive forces, are each carefully treated, the whole article being thus made as complete and exhaustive as possible.

* "A Dictionary of Chemistry, and the Allied Branches of other Sciences." By HENRY WATTS, B.A., F.R.S., assisted by eminent contributors. Supplement. London: Longmans, Green, and Co.

MANUFACTURE OF SULPHURIC ACID AND SULPHATES.—The invention of Messrs. HARGREAVES and ROBINSON, of Widnes, embraces a whole series of improvements. The object of the first part of the invention is to obtain sulphuric acid and sulphates by utilising alkali waste. They prepare the alkali waste by mixing it with a liquid, preferably chloride of calcium, then running the mixture into a closed decomposing vessel, and admitting hydrochloric acid. Sulphide of calcium is thereby decomposed, and sulphate of hydrogen liberated. A portion of the chloride of calcium formed in the above operation is used to prepare more alkali waste for being acted on. The cinders and coarse particles from the alkali waste are strained out, or prevented from passing into the decomposing vessel. It is preferred to use sulphide of calcium in excess, and to pump back into the decomposing vessel the excess which settles out. The sulphide of hydrogen is then previous to being burnt for the production, by ordinary means, of sulphuric acid, or is used directly in the production of sulphates. The second part of the invention relates to burning sulphur and pyrites in the manufacture of sulphuric acid and sulphates, and consists in adding steam or moisture to the air admitted to effect combustion of the sulphur or pyrites. Next, sulphuric acid vapour is caused to pass through, amongst, or over chloride of sodium or chloride of

r the production of sulphates. According to the fourth part of the in- chloride of sodium or chloride of potassium used in the production of s is dried in hollow plates heated by steam. Lastly, when sulphate of produced by the direct action of sulphurous acid or sulphuric acid vapour chloride of sodium in the condition known as pan salt; in consequence compactness they break it into small pieces. The same inventors when g chlorides by direct action processes, fuse the chloride and cast it into rings, cylinders, corrugated plates, spheres, or other forms, so as thereby at the proper time, a large surface to gases or vapours passing through gst them, or they mix the fused chloride with powdered or granulated de, so as to form an open or porous conglomerate for the action of the or vapour. They propose likewise to fuse the chloride in a tower or chim- communicating with a bed resembling the hearth of an ordinary reverbera- furnace, from which it is withdrawn and cast. When fusing chlorides the above first and second parts, they use pyritous coal, shales, and also rites rejected in washing coal as fuel, so as thereby to produce sulphurous to re-act upon chloride and convert a portion into sulphate. When fusing according to this invention, they allow steam to pass into the furnace to afford water, and promote the evolution or formation of hydrochloric from the chlorides. They heat the chloride before placing it in the chambers.

Royal School of Mines, Jermyn Street.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE XX.—Having examined (said Mr. SMYTH) the implements and methods of, breaking ground, we next come to the modes of ng the workmen. This is a subject well worthy of consideration, ccount of the advisability of obtaining at the same time the imum of economy and the maximum of work we may get from able and willing to do all that can be fairly expected of them. rge a proportion of the expenses of a mine are absorbed in the working away of the rock, and other kinds of manual labour ndant on it, such as wheeling away the mineral dislodged, and dressing of the mineral when it comes to the surface, that it is a of importance not only to prevent too much being paid, but the men may be kept to their proper work, and not as by some ods be actually demoralised by the mode in which they are paid. nies of all kinds there are different grades, regulated by the dif- degrees of intelligence required, and paid accordingly. Thus, manager and over-looker are paid by the week, the month, or the , while others ought to be paid by the real actual amount of they perform in a given time. If we compare the working of l mine with that of a metallic mine we shall have to remember great differences exist as to the character of the work, and whe- the mining is done on a large or on a small scale. If we take two exam- from our own mines, and select in each case one on a large scale, we shall the comparison as follows:—

COLLIERIES.		METALLIFEROUS MINES.
l viewer	corresponds with ..	Inspecting captain and manager.
dent or under viewer / overmen	" "	Chief resident captain and sub-captains; grass-captain, who has charge of surface arrangements.
ty overman	nearly parallel with	Pitmen or shaftmen.
e men—whose duties most important in ry mines	" "	Timbermen—who put up the supports to the roof and sides.
an—his duty is to go d to all the workings the men, to see that l is safe	" "	No equivalent.
rs—the actual work- g miners, who cut the ground	" "	Tributers and tutworkmen.
rs and rolley drivers	" "	Trammers.
etters or hangers-on	" "	Fillers.
rkeepers or trappers	" "	Not needed.
At the surface—		
smen	" "	Landers.
eeners	" "	Dressers.
ths and carpenters	" "	Smiths and carpenters.
ine-men	" "	Enginemen.

ides these, will be to each of the staff belonging to the office, as clerks and bu- managers. The purser in Cornwall is the man who has the expenditure money.

n one of the largest mines in Saxony (Himmelsfurst), where 754 persons are loyed, the work is apportioned in a very similar manner—1 surface captain r-steiger), 1 underground ditto, 16 under captains (showing that supervision continental mines than our own), 362 miners and hewers, 54 tim- men and masons, 122 trammers, windlassmen, and fillers, 171 dressers at the face, 21 smiths, 3 enginemen, 2 watchmen, and 1 clerk; total, 754. In our country a mine of similar size and character employs 1098 persons, as fol- :—Agents, 10; pitmen and timbermen, 11; tutworkmen, 250; tributers, 19; mmers, fillers, and landers, 74; labourers, or simply assistants in the sort of ; boys, 21; making underground a total of 394. At the surface there —agents, 9; smiths, 18; carpenters and sawyers, 19; masons, 12; engine- s; labourers, 111; foundry and on railway, 37; dressingmen, 122; boys, girls and women, 204: total, 704, making together, 1098.

n one of these there is a great deal of work to be done at the surface, and it rally finds employment for the old men and boys, women and girls, who to be found in every district, as well as the men who do the hard work down w; and a large mine, therefore, is always, if fairly prosperous, a great sing to any neighbourhood where it is found. It is evident that for the work supervision people must be paid by time, and in coal mines that is generally y the week or month; but all attempts to pay the workmen by time have ved unsatisfactory, and it is generally conceded that when men have to work themselves in remote places it is better to reckon by the work done, or the e." The rate at which such payments are made necessarily differs with nature of the work. The men generally work in shifts of eight hours. Sup- ing it is agreed that a man shall bore holes and put in two or three shots ft, the person charged with the supervision must not be satisfied if he hears shot that the work is done, for it is by no means uncommon for an idle and honest workman to so tamp the hole as to make it go off like a gun, and then make it serve again, and, perhaps, a third or a fourth time. In such cases s is the report of the explosion, but no corresponding effect is produced on e rock. Even in quarrying, when the work is in the light of day, and super- on is comparatively easy, the over-looker must gauge the depth of each hole fore it is charged, or, if his neglect to do so can be counted on, it is more than ssible that the holes will be far short of their proper depth; and he ought to see that they are put down at the proper place to produce the best re- ts. It is, in fact, impossible to get a fair amount of work out of the men thout interesting them in their labour. With regard to hours, two shifts of eight hours) per diem is the rule, but when there is unusual expense in ping up the engine-power a night shift of another eight hours is often or- d, so that the machinery is kept going during the whole of the 24 hours. is frequently the case in making shafts, whether from the surface or from nces themselves, for opening out pieces of new ground in search of fresh s of ore. It sometimes happens that working places are so restricted in ture and the men have to labour in such constrained attitudes that it is better ave four shifts of six hours each, the number of men employed under such ficulties being two or three, or at most four, at a time. The hours of in-pec- on may be carried on for a greater length of time, and the men at the surface rk 10 or 12 hours. In coal mines affairs are greatly different in various dis- ts. It is important as regards the safety of the men to consider whether y shall be required to work one shift or two. In the North of England the n go to work as early as 3 A.M., so that by 10 or 11 o'clock the first shiftmen re done, and have the remainder of the day for rest and amusement. These re succeeded by a second shift, who come out in the evening; and other men e employed in setting timber props, while some work on the roadways, keep- g them clear and open. In Wales the men will not consent to this system, and go down for one shift per diem. It thus happens that if an accident occurs e lives of all are endangered, while in the North of England half at least escape. other cases men are employed specially on particular portions of the work, as, r instance, while in one colliery the men have to hole, or kirve, and cut down, other one set will be employed to hole and a different set to wedge down or ear. The ordinary system in metalliferous mines is to make bargains, and to y according to the progress made. This is called tutwork, or dead work; and you ask the question you will be told that there are so many dead-men at work ere. Todtwerke is a German word, corrupted here into tutwork. Winzes or ts have frequently to be sunk from one level to another, and the bar- ain may be to sink these, and to remove a certain height and length of the ound. This sort of arrangement is called fathom-tale in England. Great judg- nt is requisite in the agent who has to make these bargains. It is, generally aking, by the fathom, and the price will depend on a greater variety of con- ions.

1.—The size of the shaft or excavation, which, as it may be larger or smaller, ll vary the price paid. The medium size of a level may be put at 6 or 7 feet h and 4 feet wide: if it should go beyond those dimensions the enlarged ze will make a serious difference, and if below it will not be economical to ttempt the use of gunpowder.

2.—The actual hardness of the rock.

3.—Its jointiness, and whether it is vughy or cavernous.

4.—Whether it is wet or dry, as it not unfrequently happens that the miner s to work in places streaming with water, which is not only unhealthy and comfortable, but makes the progress very slow.

5.—The price of living in the district, a matter of considerable importance in w countries where prices may be of an exceptional dearness.

6.—The depth from the surface and the state of ventilation in which, if it be a good state, the men do better work, with the same amount of labour.

7.—The nearness or remoteness of the miners' dwellings, as those who have r to come cannot be expected to do so much work as those that are close at hand.

8, and lastly.—The distance the material has to be conveyed, and whether the mming is included in the bargain.

ommon in all mines to supply the materials needed by the miners, such as powder, candles, oil, safety-fuses; and commonly the tools and smiths' charges—and all these have to be paid by the men out of the lump sum con- ted for. These and the subscriptions to the sick club and burial funds and the schools are paid nominally by the men, but the wages being calculated a little higher for the purpose they are really paid by the proprietors. These things are well managed in some districts, but in others they do not work so smoothly, some alteration of the system seems to be necessary. Then, again, the quan- ity of work s what is called "stinted." Thus the price would be so much per fathom while the ground is of the same character, but when it changed there would be a fresh stint. These "tutwork" bargains are often taken by several men in partnership; and suppose there were six men in such an arrangement their bill would run in this wise: "Such and such a mine to John Jones and Co., 3 fms. 3 ft., at 9l. — 31l. 10s." Then from this will have to be deducted—80 lbs. candle, at 8d. = 1l. 6s. 8d.; 62 lbs. of gunpowder, 1l. 11s.; safty fuses, 6s.; sharpening tools, 3l. 4s.; doctor's fund, 2s.: total, 6l. 16s. 8d., leaving a balance of 24l. 13s. 4d. to divide between the men.

It is obvious that nothing but thoroughly knowing the nature of the work, and what men can do, will enable a manager to make proper bargains. The ground being squared up, it is examined by the men, and then put up, as it were, at a sort of auction to the best bidder, so that if one set of men are unwilling to undertake the work others can come in and take it. This is very fairly managed in the south-western districts. The manager invites offers, and the first bidder will offer to do the work at (say) 15l. per fathom; then another will say 12l., and so on, until the manager or agent thinks a fair price has been arrived at, when he throws down a pebble, which is equivalent to the fall of the auctioneer's hammer, and the bargain is closed. If the ground proves easier than was expected the men are enabled to get a larger amount of wages than was apparent on their bargain, but on the other hand, if the ground goes against them they have to work harder or get less money than they counted upon. If, however, the manager is convinced the men are doing their best he will judiciously give them a better price next month, and so make it up to them. The men, however, are mostly good judges of what the ground is likely to be, and seldom or never make a bargain which would be absolutely disastrous to them. There are modifications of this plan which come into play in the case of materials of which large quantities are required for sale, as coal, in getting which the men are often paid by weight; or in slate quarries, where the amount of rubbish is enormous, where they are paid by bulk. In collieries men undertake to cut the coal and put it into tubs at so much per ton or tram, which is the same thing. Every tram must be fairly filled, without smalls or rubbish, and when it reaches the surface it is weighed by a man appointed for the purpose, and the men, if they chose, can employ a check weigher. All, then, that the manager at the top has to do is to see it is coal that is sent to the surface, but if any workman is careless or dishonest enough to load with stone amongst the coal the manager has a right to reject that tub, and so the weight of what coal is in it is lost to the workmen. They know, however, well enough that an admixture of shale, or clay, or stone with the coal goes against the trade, and so they are generally very careful in this respect, and give very little trouble. Then, in slate quarries where large quantities of rubbish have to be removed, thousands of tons at a time falling into the quarries, it is a matter of calculation what shall be paid to the men by the quantity.

In some mines a combined system of payment is carried out. Thus, in the South Tamar Mine the tutwork is done at so much per running fathom, while in the case of the Carn Brea Mine that would not do at all by itself, but is combined with tributing. The tributer imagines from the appearance of the strings, perhaps, that if he advances a little further they will come together and produce more ore than is visible at the spot then in view, and so he works with a view to his getting a better chance of making wages, and is always on the look out for such appearances and chances. It is this which makes the system of tributing so useful. It brings in the experience, judgment, and acuteness of the men who have been working any length of time in a particular ground, to the mutual advantage of the tributer and the proprietor. He undertakes to work away a given area of the mine, called a pitch, consisting of so many fathoms in length and height, and take out all the ore he can; and for this he is to have so many shillings out of every pounds worth of ore. It is thus to his interest to examine carefully the rocks he passes through, to keep his eyes well open, and to carry in his memory all the places which he has observed as promising well; and it is equally good for the adventurers. But the system has drawbacks. It may, and does, sharpen the wits of the men, but that is a two-edged sword, which cuts both ways. The men imagine that if they conceal or keep the knowledge of favourable appearances to themselves it will be to their advantage in making their next bargain; and they consider that they are justified in so doing. Their morality, perhaps, is not of the highest grade, but human nature, after all, is the same down in a mine as at the surface. A careful manager must, therefore, be always on the alert to see that no such tricks are tried. The temptation, no doubt, is great, as it not unfrequently happens that when one tribute pitch is let at 15s., another at 1l., and perhaps at no greater distance a third will be only 5s. This leads to the dishonest transfer of pieces of ore from the richer place to the poorer—a distinct robbery on the management of the mine, which has to be guarded against by the vigilance of the agent. Sometimes, when the men are paid by the quantity of material broken down, they are allowed, also, something on the ore obtained from it. When the ores are of the more precious metals special arrangements must be made to prevent the waste of the smallest particle of metallic material.

LECTURE XXI.—There are many kinds of open working which fairly come under the designation of mining, their methods and objects being similar. In the early days of mining metalliferous deposits were frequently attacked at starting on an outcrop with open workings. The first thing in such cases is to remove the overburden, as it is called, which consists generally of vegetable soil, of gravels and sands, or other alluvial deposits, and other material of a valueless character. The labour required is of a simple, unskilled kind, but it often happens that a large amount of prevision and contrivance on the part of the manager will be required. Taking, by way of illustration, a working at Stanton, in Derbyshire, for ironstone, a drawing of which in its condition some years ago was on the wall, Mr. SMYTH pointed out that the face of the working was 60 ft. in length, and vast quantities of material were thrown down by shots put in at the surface. The iron ore, which *in situ* appeared in bands, with intervals of other but useless material, was picked out and stacked until it could be removed for conveyance to the smelters. At starting the work began on a hill side. The vegetable soil would be carefully removed if it existed in any quantity, and put aside, with a view of replacing it when the mining advanced far enough to admit of the excavation being filled in with the refuse. In this case a stationary engine was erected at the surface, from which inclined planes of rail were run down to the bottom of the workings. By this means the ironstone is not only drawn up to the level of the engine, but the attle or refuse is brought away from the face, and being tilted at the top, and heaped out of the way, is afterwards roughly levelled for the reception of the vegetable soil. By this process, however, a large space has been gradually opened. And here I may take the opportunity of pointing out that a line must be drawn in arrangements of this sort between this country and others as thickly populated, and new countries like America, the necessity of remaking the ground surface destroyed by excavations being hardly known in the latter, while in the former it is a duty incumbent on the engineer in almost all instances. In many cases when a mine is commenced on a hill side with open workings it is necessary also to run an adit level to drain the superincumbent mass. The removal of the overlie in cases of this kind seldom offers any special difficulties unless the material be of a very adhesive character, when it will require special management. The removal of the overlie depends greatly upon the physical character and condition of the ground. Another sort of open working is what is called "patching" in some districts, particularly in South Wales; a cheap way of getting ironstone, consisting simply of working away at the hill side, and which becomes only a case of drawing away the material, arranged according as the work is done with a single stope or step, or a series. The latter plan is usually adopted, as it allows of the employment of a greater number of men. In foreign quarrying the latter is the method usually adopted; and, indeed, in our own slate districts of Wales, and where building stone is got on a large scale, a succession of stopes is indispensable.

Passing to the subject of stream-works, which are opened for gold in some countries and for tin in our own, it becomes a primary question to know how to dispose of the alluvial stuff at the top. Supposing we are dealing with a valley, and a stream running through it, the question is first how to get rid of the water. If we have the opportunity of digging down, and thus getting rid of the water, the case is much simplified; but suppose the case of a flat bottom, where there is no great fall for water, if we would remove the material as fast as it is dug out we must devise some means of disposing of the water. The most remarkable of these stream-works in this country are those at Pentuan, in Cornwall, which occupy the whole valley for miles in length, and where a succession of steps are formed in the superficial ground which lies over the tin ore sought for. The bottom, or what is called the "shelf," is composed of killas, with occasional dykes of elvan, and steps are formed in the alluvial deposit by which a large number of men can work at once. In this case the natural streams of water running down the valley is so managed as to do the work of washing; and it is so utilised, by means of well-devised culverts, along which the water is conducted. Of course the process is much cheapened when it can be done by a natural stream, but otherwise a steam-engine or a water-wheel may have to be brought into play. In the New World superficial deposits of auriferous sand and gravel of a valuable character exist sometimes to a great depth. At the Whitehaven lead, for instance, at Ballarat, the valuable detritus is 319 ft. in depth. In the operations necessary to work there it becomes necessary to turn the course of considerable streams; and to keep up communications between the higher and lower workings by means of arching in masonry; and to make culverts so that the water may flow down the workings under the waste material, which is got rid of by throwing it on the top of such culverts. In some instances roads have to be changed, to obtain leave for which in this country would take not a little both of time and money, while in California you may have only to arrange with your next neighbour, who most likely would be interested in the change as much as yourself. The cost of removing the overburden, if done by manual labour entirely, is very heavy, and particularly in new countries like California, where labour is dear. The Californians, to meet this difficulty, have introduced a system which they call "hydraulic mining." Water is brought from reservoirs or tanks by what are called "flumes" or aqueducts, which are placed at an elevation of 130 or 140 ft. above the auriferous gravel to be acted upon, and there will be a mass of from 120 to 160 ft. of gravel to be removed. The water thus conveyed passes into a large wooden tank, or "box" as the local term is. This box is provided with a valve, and from it the water is conveyed to the bottom of the working by means of a sheet-iron rivetted pipe from 8 to 14 in. in diameter, in the sides of which are apertures provided with slide-valves and union-joints, to which four or five flexible tubes or hose are attached, each ending in a nozzle of bronze 2½ to 3 in. in diameter. From these powerful jet streams are directed against the face of the working with a force which, it is said, can only be compared to that of ordnance, and where the supply of water is large, and the fall considerable, the effect is perfectly astonishing. The quantity of material dislodged by a single arrangement of this kind is greater than could be produced by a regiment of navvies, and its economy, therefore, is extremely great. Mr. J. A. Phillips, in his recent excellent work, entitled "Mining and Metallurgy of Gold and Silver," gives as an illustration of the amount of work which can be performed in a given time by hydraulic mining the results obtained at the Eureka claim, near San Juan, California, where the bed of "pay dirt" is about 135 ft. in depth. The upper portion of this deposit, to the depth of 70 ft., does not contain a large amount of gold, but is easily worked, whilst the lower portion, having a thickness of 65 ft., is much richer, but cemented together, and the work is, therefore, carried on under conditions of considerable difficulty. The pay dirt is reached by a bed rock tunnel of great length, which costs on an average $8 per foot, and of which the total expense was $28,000. The works is carried on by means of four jets d'eau, discharging together about 208 gallons per second, or 12,500 gallons per minute, under a pressure of 140 ft. The whole of the operations are conducted by four men, and at the expiration of 10 working days the washing down of fresh earth is suspended, and the sluices cleared up. In these 10 days 36·500 cubic yards of gavel are worked over. All that the men have to do is to direct the nozzles, and no human labour can be placed in comparison with the system, either in effect or economy. Mr. Phillips gives an interesting statement of the cost of these 10 days, as follows:—Cost of water, $1000; labour, $173; sundries, $100: total, $1273. The average quantity of gold obtained in this period is worth $6000. This is sufficient to give an idea of this admirable method of removing the over burden when it is composed of loose material; but when it is more adhesive charges of powder must be used.

There is another species of open work to which I have already alluded, in which the whole material might be valuable, as in the case of building stone and slate. In opening quarries of this kind care must be taken at starting that the works shall be well drained, and that there shall be a free exit for the rubbish, which is often enormous in quantity. The next question will be whether the material shall be wrought in one face or several. These are points which will be influenced decisively by local circumstances. In cases of material in which that part only has to be removed through which metallic particles are disseminated irregularly the workings will inevitably lack regularity. In England the most remarkable case of this kind is presented by the great open workings for tin at Carclaze, near St. Austell. A great amount of mineral has been removed in following the valuable tinstuff, and vast cavities have been opened to the height of the hill top, and ¾ mile in breadth, and it presents a most interesting example of excavations on a gigantic scale. Smaller examples are not uncommon where the killas or schistose rocks of a particular kind in which a little tin is found have been removed, leaving the rubbish behind, and thus a good deal of tin ore has been obtained at an extremely small cost of carriage. On the Continent there are remarkable instances of this class of workings at Altenberg, Ehrenstein, and at Staggenwald, in Bohemia. Scandinavia, too, has some valuable deposits of this kind, which have led to the famous open workings at Dannemora in Sweden, at Arundal in Norway, and at Fahlun near Stockholm, at which latter place vast quantities of copper ore having been extracted by open quarrying, they are now proceeding by subterranean excavation. In the same way, at the Parys and Mona Mines, in the Isle of Man, the nature of the occurrence of the copper ore enables the work to be carried on in a manner similar to that practised at Fahlun.

After a time, however, it will probably become a question as to whether the mine shall cease to be carried on as an open cutting. At a well-known mine in Saxony, where they had to work upon a dome of granite enclosed in schistose rocks, it was considered better, even when the excavations were very deep, to hold on as an open working; the men were better overlooked, and the application of hydraulic machinery could be effected in a cheaper way. But when the overlie gets to be 100 or 150 ft. in height it becomes a serious question as regards the safety of the workmen. There is a limit beyond which such vast open workings are no longer compatible with safety, and that limit depends upon the hardness and dip of the material; and even in slate quarries there is a constant danger of falls, to the great risk of the men working below.

There is no more important mining industry in our own country than slate quarrying. An intelligent Prussian engineer has lately given some statistics on the subject, and he states that in France 188,000 tons of slate (the weight being that of saleable material) are annually obtained; in Germany, 78,000; in Belgium, 25,000; in Scotland, 12,000; in England, 60,000; and in Wales, 470,000 tons. Thus, it will be seen that slate quarrying is a branch of mining operations to which a great deal of skill, as well as capital, must be brought. In the Geological Lectures a good deal of attention has been given to the cleavage, as well as to the deposit of the beds of slate, and you will remember that there is a considerable amount of regularity to be found in those particulars. Thus, a particular plane of cleavage will be found to stretch through a whole line of country, with scarcely any deviation. And where the original line of deposition is not visible the miners must be careful not to take the plane of cleavage to be the line of the beds. This is a matter of great importance, because it is the plane of cleavage which is looked to first by the workmen, who work parallel to those planes rather than parallel to the beds, and thus regulate the form of the quarry. There may be whole mountains of slatey rock which will not produce a ton of slate commercially valuable; and the great thing is to discover good slate. The quality even of commercial slate varies very much, and sometimes large beds which look well turn out, when worked, to be inferior to other beds which do not put on nearly so promising an appearance. The Welsh slates occur principally in the Lower Silurian deposits, which produce the blue slates got in the neighbourhood of Festiniog, and in the Cambrian rocks, which commence in the neighbourhood of Bangor, and run in a north and south line towards the lakes of Llanberis. The Cambrian division have their cleavage almost vertical, while in the Festiniog district they dip at a moderate angle (say, about 30°), the bedding being excessively confused and contorted, dipping at a rather higher angle than the cleavage. The most magnificent slate quarries in the world are at Penryhn, near Bangor. The face of the working is above 1000 feet in height, cut into a series of semicircular stages, each about 54 ft. in width, and each having a different set of men. As each working goes on step by step, and simultaneously, the whole face is gradually worked down, the whole forming a vast amphitheatre. A series of inclined planes are arranged, by which the material is conveyed to the places where they are split, and other places where the refuse is put. This plan is the best that can be devised for employing with effect a large number of men.

The next point is to secure the means not only of sending down the slate to the central places, but to remove the rubbish to be tipped over on such a portion of the mountain as there is good reason to believe will not yield good slate. This is important, because these quarries are often opened without consideration for the future, and thousands and tens of thousands of tons of rubbish have been tipped where it was afterwards found the slate was good, and which could not, therefore, be obtained excepting by removing this artificial overlay, or by underground mining. Careful arrangements must also be made to prevent unnecessary breakage of the slate by dropping it too far, or farther than is necessary, after it has been quarried. This is done by slides and various cognate contrivances, so as to let down the material from the face of the rock whence it is got to the level below. The quarrymen are hardy fellows, of unflinching courage, who suspend themselves from the heights above, or who work on narrow ledges, from which a fall would be fatal, but they seldom have any accidents, and seem not to know what giddiness or fear are. Sometimes, however, vast masses of the rock will break away, and fall like an avalanche, overwhelming all below. There is, however, generally sufficient warning to permit the escape of the workmen, but the steps below are in such cases destroyed, and the regularity of the quarry greatly depreciated. In the southern parts of these slate districts a practice obtains of following the slate vertically downwards until the face is often 200 or 300 ft. from the top, and if the rock be jointy there is a constant tendency of large masses to fall in this avalanche-like way, and the flaws not being visible at the top, which is usually covered, although perhaps very thinly, with some sort of overlie, this danger is very considerable. The sort of warnings which the men get are, perhaps, the fall of a few small stones, as the tottering mass begins to incline. This attracts attention enough to permit them to escape, because they are aware of the character of the danger, but there is neither time nor possibility of means to avert the catastrophe under such circumstances. I have known cases in which masses have fallen which have filled up an entire quarry to three-fourths of its height, and so stopped the working for many years. This arises entirely from the faulty principle on which the quarries are laid out. In all such cases the adoption of the stope arrangements, like that of the Penrhyn Quarries for instance, would have prevented the accidents, and where falls, if inevitable, would have been moderate in extent, and thus neither have imperilled the safety of the workmen nor the existence of the quarry. In laying out the workings of a quarry it is, in reference to this particular danger of falls, important to know whether the cleavage faces you or goes away from you. If the face is towards us the step must be broader to prevent falls, and then there will be some advantage in the fact that the slate when broken away will slide down to the bottom of the quarry, to be further treated and fitted for the market. It sometimes occurs that the question of a quarry paying or not paying depends upon this very point, and the necessity has happened for changing the place and beginning again. Proceedings of this kind, however, should be avoided by careful examination and study of each individual case, as the patience of shareholders is gradually worn away when it is found that at great expense the mountain side has been attacked, and satisfactory results have not followed. There are many good quarries on which from 30,000l. to 50,000l. was expended before there was any return.

STEAM-BOILERS.—In carrying out the invention of Mr. DAVID DAVIDSON, of Glasgow, according to one modification, with external furnaces, an arch-shaped casing is placed over each furnace at the front end of the boiler, and from the back ends of the casings tubes are carried along the flue below the boiler to the back end, where they are turned up and made to enter the boiler. The after parts of the tubes are by preference made smaller in the bore than the forward parts, The fire-bars of the furnaces are made to consists of wrought-iron tubes, having their ends fixed in casings, which may be connected to the casings hereinbefore referred to, or separate therefrom; and the feed water is made to pass through these tubes before entering the main boiler. The fire-door is made hollow, and with internal flanges to lead the air by a zig-zag course, so as to become heated on its way upwards to an aperture or apertures on the inner side, through which it enters the furnace. A nozzle is fitted in the centre of each aperture, and steam is supplied thereto by a flexible tube for the purpose of inducing the requisite ingress of air.

TUBULAR STEAM-BOILERS.—The invention of Mr. E. MARCHIN, of Leadenall-street, consists in constructing steam-boilers of inclined tubes, which, with their connections, form a series of complete circuits, the water, after passing through such tubes, being made to enter a steam-chamber, where the steam separates, while the water passes down a vertical tube outside the boiler, and again enters the lowermost of the inclined tube. A mud collector is provided at the lower end of the vertical tube. A safety-valve is provided for the boiler, consisting of a casing having an escape aperture, provided with a valve and a cylindrical cavity, in which fits a piston connected with the valve, in such manner that the pressure of the steam on the piston will effect the opening of the valve. The piston is held against the pressure of the steam by a spring. A water-level indicator is also provided to the boiler, wherein a tube is connected to the waterspace of the boiler, terminating in an upward bend, while another tube is carried down from the steam space to within a short distance of the other tube, and an ordinary guage glass is fitted between the two tubes, into which gauge glass, as also into the bend of the water tube, sufficient mercury is placed to counterbalance the head of water in boiler.

AUTOMATIC COMPENSATING MECHANISM FOR ENGINE GOVERNORS.—The invention of Mr. G. DENIS, of Paris, is designed to afford a simple and certain means for automatically regulating governors while preserving their freedom and "sensitiveness." He adopts two arrangements based on the same principle—the first is a differential motion automatic compensator; and the second an inverse motion automatic compensator. In the first arrangement a screw and nut and two wheels are arranged in combination with the governor. The nut has a tooth, and each wheel has a tooth or a number of teeth. So long as the engine runs at its normal velocity the nut will remain midway between the wheels, and its tooth will not come in contact with their teeth, but as soon as the speed is either increased or diminished the tooth of the nut will come in

contact with that of one or other of the wheels, and the balls will either rise or fall, and close or open the throttle-valve. In the second arrangement he employs two bevel-wheels, driven by a single pinion in opposite directions. Each wheel has a tooth designed to act on a nut which actuates the throttle-valve. A screw rod, provided with a ring, passes through the nut and the two wheels. This ring, when the engine runs at its normal speed, lies between the two wheels; when the speed varies the ring engages with one or other of the wheels, and the nut is thereby raised or lowered.

CASUALTIES IN COAL MINES.

Several enquiries having been made as to the character of the essays which should be sent in to compete for the premiums offered by Mr. EDWARD HERMON, M.P., it may be stated that in this respect the widest latitude is allowed. The sole object at which Mr. HERMON aims is to prevent the loss of any life in a coal mine, if that loss can be prevented by the substitution of any other system for that now in use; and the essays which go farthest to facilitate the attainment of that object will receive the awards.

The premiums offered are very handsome ones—being 150*l.* for the best essay and 50*l.* for the second best; and the adjudication of the premiums will be made by gentlemen whose co-operation Mr. HERMON has been very fortunate in securing, and whose award will give confidence to all classes. The adjudicators are—

Mr. PETER HIGSON, H.M. Inspector of Mines for the North Wales and West Lancashire district.
Mr. FRANK N. WARDELL, H.M. Inspector of Mines for the South Yorkshire district.
Mr. RUPERT KETTLE, of Wolverhampton.
Mr. A. STAVELEY HILL, Q.C., M.P.
Mr. THOMAS HUGHES, Q.C., M.P.

Although it is a distinct condition that phraseology and spelling shall not influence the award, it may be well to suggest that the competitors should be careful to write legibly, and on one side only of the paper; because it will be much more easy for the adjudicators to comprehend the views of the competitors if they can rapidly understand the statements made, than if the writing is so difficult to decipher that the first part of a statement is almost forgotten before the end of it can be reached. The latest date at which the essays can be sent in has been fixed for Wednesday, February 28, and all competitors should forward their papers through the post, addressed to Mr. EDWARD HERMON, M.P., Winckley-square, Preston, who will see that all are carefully brought to the notice of the adjudicators.

We may repeat that the prize essays will be published in the *Mining Journal*, and possibly some of the others also.

MINES REGULATION BILL.

The object of this Bill—leave to introduce which was given on Monday night—is to protect children from labour in the mines at too early an age or for excessive periods, and to bring about a diminution in the large number of accidents, so far as such accidents arise from preventable causes. This object the Bill seeks to effect by prescribing general rules for uniform observance in mines, and requiring special rules to be made for each mine, all of which rules the owner and agent are bound under penalties to see carried out. The gurantees for the enforcement of these rules are a staff of Inspectors, to which it is intended to make some increase, and an entirely new provision, whereby every mine is to be placed under the control of a certified manager, who, as well as the owner and agent, will be responsible for any non-observance of the Act, through his liability to the loss of his certificate, as well as to penalties.

The provisions of the Bill which specially call for attention are the following:—

The Bill applies to mines of coal, mines of stratified ironstone, mines of shale, and mines of fire-clay.

The age for admission to the mines is fixed at 10; boys from 10 to 13 are to be half-timers, and as such are not to be employed in any one week more than three whole days or six half-days, the maximum of a whole day's employment being ten hours and that of a half-day's employment six hours. Such boys are to attend school eight hours every week, without counting attendance at Sunday-school or night-school, or school before 8 in the morning, or any attendance in excess of three hours at a time or five hours in a day. Lads from 13 to 16 are restricted to 56 hours of labour per week. For all under 16 an interval of rest of 12 hours is secured between each day's employment, except between Friday and Saturday, when an interval of eight hours will be permissible, in order that the boys and lads may by beginning work earlier on Saturday morning be able to leave earlier in the day, and so enjoy the Saturday half-holiday.

Sufficient intervals for meals are secured whenever the period of employment exceeds five hours.

The person in charge of an engine for raising or lowering miners is required to be 18 years of age. If the engine is worked by a horse, the person directing the driver, and not the driver himself, is, as under the existing enactment, to be deemed to be the person in charge of the engine, but the driver is required to be 12 years of age. Where wages are paid according to the quantity of material wrought, payment is to be made exclusively by weight, save in exceptional cases, where, from local exigencies, measuring or gauging may be sanctioned by special exemption from the Secretary of State. The use of the standard weights is to be enforced, to the exclusion of any conventional system.

Double shafts are required, and the communication between the two shafts is to be throughout not less than 4 ft. wide and 3 ft. high. The enforcement of this enactment is, in the case of such mines as are not now required to have two shafts, to be postponed to Jan. 1, 1875, and the power is reserved to the Secretary of State to exempt fire-clay mines, wherever a second shaft seems unnecessary. In accordance with the precedent of the Merchant Shipping Acts, each mine is to be under the control of a manager, to be appointed by the owner, who may appoint either himself or some other person. But the manager must be certificated. A certificate is only to be obtained by a person who passes an examination conducted by examiners appointed by the Secretary of State, and gives satisfactory evidence of his sobriety, experience, ability, and general good conduct. It is intended that this examination should be conducted locally, and be of a thoroughly practical character.

To this rule, however, an exception is made in favour of those who were in the position of managers on Jan. 1, 1872, and have continued to be so up to the passing of the Act. Such persons will be permitted to take out certificates without passing an examination.

If at any time an Inspector of a district reports that an enquiry is expedient to ascertain whether a manager is, by reason of incompetence, drunkenness, or gross negligence, unfit to discharge his duties, the Secretary of State may direct a formal public investigation to be conducted by a Court to be specially constituted for the purpose, and the Court will have power to suspend or cancel the certificate of the manager, power of remission being reserved to the Secretary of State.

The general rules contained in the Bill of last session are amended, and additions are made to them. If any person contravenes or fails to comply with any general or special rule, such person, and also the owner, agent, and manager, are each to be criminally liable; but each may exonerate himself by proving that he took all reasonable means to prevent such contravention or non-compliance.

The principal amendments to the general rules, as contained in the Bill of last session, are—1. That in the first general rule, which requires ventilation sufficient to render the mines safe under ordinary circumstances, the words "under ordinary circumstances" are expunged.—2. That further restrictions upon the use of powder in fiery mines are introduced.—3. That guiding and signalling machinery are to be provided in deep shafts.—4. That provision is to be made to prevent the rope slipping either on or off the drum.

The principal additions to the general rules are the following:—The owner, agent, and manager of the mine are to be required to see to the propping of the roof and sides of the working places, as well as of the roadways; to cause an inspection to be had of the ventilation before workers are admitted to the mine, and of the mine generally every day; to withdraw the workmen in case the mine be found in a dangerous condition; to allow the workmen once a month to inspect and report upon the mine. To appoint in each mine a station or stations beyond which workmen are not to go without special authority; to allow the workmen the option of using either the downcast or upcast shaft where each is available for ascending or descending, and to have a man in attendance to raise any workman who is in the mine. New special rules are to be required in the case of each mine after passing the Act.

With regard to abandoned mines the side entrances are to be fenced as well as the top of the pit shaft, and the maps to be deposited are to be copies of the most recent working maps.

The Metalliferous Mines Bill follows the Coal Mines Bill in its provisions as to the employment of boys and lads under 16, but the provisions requiring that every mine should be placed under a certified manager is not incorporated, being deemed unnecessary.

The general rules are for the most part the same as those contained in the Metalliferous Mines Bill of last session, the most important additions being the general rules which relate to the following matters:—The restriction upon the use of powder, the placing of ladders and supplying the ladder round with sollars at certain intervals, and the separation in the shaft of the ladders or man-engine from the machinery for raising the minerals. From some of the provisions of the Bill mines are exempted wherein not more than 12 persons are employed underground; and, in consideration of the honeycombed character of some of the mining districts the general enactment requiring all abandoned shafts to be fenced is qualified by certain limitations; but no shaft is to be left unprotected which the Inspector of the district requires to be fenced.

FOREIGN MINING AND METALLURGY.

Orders are arriving freely at the French coal mines, and coal is also delivered more easily, thanks to the falling off in the sugar-works traffic. There is, further, less discontent with the railway administrations, and the managers of the Eastern of France Railway even come in for a certain meed of praise. The engineer-in-chief of the Department of the Nord has presented to the general council of that department a very interesting report upon the progress of coal extraction in the district. It would appear that the extraction of coal effected from the coal basins of the Nord declined in 1870, as compared with 1869, to the extent of 56,200 tons. On the other hand, the extraction of the Pas-de-Calais experienced in 1870 a slight augmentation. The Anzin Mines, which alone produce three-fifths of the whole extraction of the basin, suffered the most from political events, as they make more distant deliveries than any other local workings. It is curious to note that half the production of the coal basin of the Nord is consumed out of the department, and that Belgian coal at the same time figures in the consumption of the Nord to the extent of one-third. The engineer-in-chief considers that the interests of the coal basin of the Nord would be greatly promoted by a prompt completion of the Valenciennes and Aulnoye Railway. Prices are maintained with the same firmness as hitherto. The Ahun Collieries Company will pay on July 16 a dividend on account for 1872 at the rate of 12s. per share.

All the working miners in the Charleroi basin have resumed their employment; the demand experienced for coal is, however, still so active that it is met with difficulty. There are hardly any stocks at the pits' mouths, boats and railways carrying away supplies as fast as they are made available for consumption. Freights to Paris have fallen; prices of coal, on the contrary, are very firm; coke is also scarce and dear. The demand for domestic qualities of coal continues active and pressing, and the maintenance of prices with firmness is considerably assisted by this circumstance. From the basin of the Couchant de Mons cheering advices also come to hand; plant is scarce, but stocks, notwithstanding this circumstance, are of no great importance. Skilled miners are now earning what are regarded as the high wages of 3s. 8d. to 3s. 10d. per day, and as the orders on hand are considerable it is expected that this rate of payment will be continued for some time. In the Liége basin complaints begin to be heard that deliveries are decreasing on foreign account; in consequence of transport difficulties, coal from the Ruhr basin has obtained more ready access to markets formerly enjoyed by Liége coal, and a serious competition has resulted in consequence. The Belgian Government appears disposed to do its utmost to remedy all transport difficulties, and some writers contend that, after all, German industrials are not much better off than their Belgian neighbours in the matter of railway traffic. In Silesia, for instance, the railway situation is far from being good, and very large stocks have accumulated at the pits' mouths and at the railway stations. There appears, also, to have been some over-speculation in coal in Germany. The exports of coal from Belgium in October amounted to 413,316 tons, against 119,657 tons in October, 1870, and 351,997 tons in October, 1869. In the total for October, 1871, France was represented by 369,349 tons, the Low Countries by 40,555 tons, and the Zollverein by only 3266 tons. The exports of coke from Belgium in October were 53,535 tons, of which 27,528 tons went to France, and 25,182 tons to the Zollverein. The coke exports of October, 1871, exceeded those of October, 1870, by 25,681 tons, but were 9449 tons less than those of October, 1869. The Basse-Sambre United Collieries Company will pay, March 1, a dividend of 1*l.* per share for 1871.

A proposition of M. Laurier for the purchase of the French railways by the State has excited some commotion in the French industrial world, as it is feared that industrial interests would suffer by the change. However, whether these views are well founded or not, it does not appear probable that the proposition of M. Laurier will be accepted just at present. There is no material change to note in the state of the French iron trade; it is still characterised by general activity, and, if the state of affairs be not so brilliant as in Belgium, it is still far better than could have been expected a few months since. It is stated that the Mazeline establishments at Havre, more generally known as the Forges et Chantiers de l'Océan, have been purchased by MM. Béhic and Dupuy de Lôme, on behalf of the company styled the Forges et Chantiers de la Méditerranée. The combination appears a good one, and is likely to be favourable to all parties. The price of Bessemer steel is still lower in France than in England, Germany, or even Belgium; the bulletin of the committee of French forgemasters gives a reason for this by showing the scarcity of minerals in England, and the abundance of similar supplies in France for many years to come, thanks to the bearings of Corsica, Bidassoa, &c. This explains the considerable increase presented by the production of Bessemer steel in France of late years, an increase which seems likely to continue. There is no change to report in the prices of iron upon the French markets.

Prices of raw materials are increasing in Belgium at a rapid rate. The condition of the Belgian iron trade still continues, however, highly prosperous, and the contracts which industrials have on hand will occupy them until August or September. For the present firms and companies are refusing fresh contracts, as they are hoping to obtain orders at more remunerative rates; this tendency on the part of industrials is, however, becoming weaker. The demand on railway account continues just at present the most urgent and the most inportant; the number and importance of the new concessions granted in Hungary, Roumania, Turkey, and Russia seem to predict a long and brilliant future to the iron trade; but one must not speak with too much confidence upon the subject. Upon the Charleroi market merchants' iron is quoted at 8*l.*, 8*l.* 12s., 9*l.* 4s., and 10*l.* per ton, according to classes. Plates have experienced a slight advance. Rails are scarce, and some orders have been obtained at a little above 9*l.* per ton. It appears that the exports of rails from Belgium in October, the last month as to which we have official information, amounted to 9293 tons, while those of plates were 2345 tons. The exports of iron of every description (exclusive of minerals and limailles) from Belgium in October amounted to 35,452 tons, showing an increase of 14,793 tons over the corresponding exports of October, 1869, and of 15,322 tons over the corresponding exports of October, 1870. The exports of steel from Belgium in October appear to have been comparatively trifling.

At Paris, Chilian copper delivered at Havre has made 89*l.*; ditto in ingots, 90*l.*; ditto tough English, 95*l.*; and Corocoro minerals, pure standard, 90*l.* per ton. At Havre, Chilian in bars has made 90*l.* per ton, but more recent advices show some weakness in quotations; English has brought 88*l.* to 91*l.* per ton, and Spanish 86*l.* per ton. Copper has been generally firm upon the German markets; the Dutch markets have not experienced much change. ... presented irregular quotations. At Paris prices have slightly ... way; English tin, delivered at Havre and Paris, has brought ... Straits, 154*l.*; and English, delivered at Rouen, 152*l.* per ton ... Rotterdam the business passing in tin has been comparatively limited; Banca has been held at 85 fls. Billiton is extremely ... An advance has been easily established in lead by the principal ... gian and Prussian firms producing that metal, as the consumption is large, and appears likely to increase. French lead, delivered at Paris, has made 19*l.*; Spanish, delivered at Havre, ... and English, 19*l.* per ton. At Rotterdam, Stolberg and ... have made 11¼ fls.; and German, of various marks, 10¾ fls. ... sustained its price tolerably well. Silesian zinc, delivered at ... has made 24*l.* per ton; ditto, delivered at Paris, 23*l.* 16s. ... Vieille Montagne zinc in sheets has brought 30*l.* per ton at ...

FOREIGN MINES.

SIERRA BUTTES.—Result of the "clean-up" for January ... ceipts, $27,210; 2262 tons of ore were crushed during the month. Cost of ... and milling the same, $4·94½ per ton = $11,174. Water irregular; ... improvement next run.

PACIFIC.—Telegram from the superintendent:—Mails snow ... Production of silver since "clean-up" (end of December), $20,000. ... stop Mettacom mill awhile, wood exhausted. Batters' ledge worth ...

JAVALI.—The directors have received advices from their ... Capt. Sohns, accompanying a remittance of gold bars, valued at ... 2300*l.*, for the months of November and December, at a cost of 1200*l.*; the ... yield was 11 dwts., against 7 dwts., the former average. Capt. Sohns ... a discovery a day or two before the departure of the mail of a very rich ... which he encloses a sample.

ECLIPSE (Gold).—H. Tregellas, Feb. 13: Telegram: Serious ... lays by storms, now going on well smelting silver ores, large quantity on ... Bluett's vein yielding well, and will forward $25,000 silver monthly.

ANGLO-ARGENTINE.—J. Vivian, Dec. 20: Gualilan: The ... the arrastres has been prepared, and the delay in getting them to work ... tributable to the non-arrival of driving-gear, &c. The arrastres have ... driven off the engine, and in the absence of shafting, belting, and gear ... this cannot be done. We have now on the mine gear work for two ... which only arrived in October; the last instalment may be expected in ... Two arrastres are now permanently fixed, and the driving-gear of the ... being connected to the engine; these will, probably, be sufficient for ... mating for the present. Returns may be expected at the time mentioned ... letter under date Nov. 6. In the letter of that date Capt. Vivian states ... think I may safely promise you that we shall commence making returns ... latter part of January or the beginning of February."

PONTGIBAUD.—W. H. Rickard, Feb. 2: Roure: The 80 metre ... south of Agnes' shaft, is unproductive. The 60 north, on Virginie's lode, ... ½ ton of ore per fathom, and the same level south ¾ ton. The 4 ... winze, yields also ¾ ton, and the 40 north ½ ton of ore per fathom. ... north, on the eastern part, yields stones of ore irregularly. The same level ... the main part, has entered unproductive ground. The 20 south yields a ... saving work. The adit north yields ¾ ton of ore per fathom, but the ... end is poor. The cross-cut at the Stollen, west of Paul's shaft, is in ... dered ground. The same level, on the western part of the lode, north of ... shaft, yields stones of barytes, spotted with lead ore. The Mill adit level ... has entered a very kindly lode, yielding 1 ton of ore per fathom.—La ... The 100, north of Nosky's shaft, is poor; we have set to drive this level ... western part of the lode, which will open out a little tribute ground.— ... The winze in the bottom of the 20 opens out tribute ground worth ½ ton ... per fathom.—La Brousse: The sinking of Basset's shaft below the 12 ... to be spary; the ground is hard and wet. The 120 metre level south ... little saving work of low quality, and the 100 south 1 ton per fathom. ... in the same direction, yields ore stuff of low quality. The lode in the ... ordered and poor; the lode, where being underent, behind the end, ... yield from 2 to 2½ tons of ore per fathom.—Pranal: The 70 metre level ... yields a little saving work, and the same level south 1½ ton per fathom. ... 70, on the eastern part, north of No. 2 winze, is poor. The 50 north is ... productive. The 30 south is still in stiff, close rock. The 8 north, on the ... ern vein, yields ¼ ton of ore per fathom.—Surface: The dressing has been ... ried on without interruption, and our samplings have amounted to ... St. Amant: The 25 metre level, north of Susan's shaft, contiues in a lode ... wide, of kindly appearance, producing stones of lead ore and carbonate of ... The same level south shows spots of lead ore, and the lode is very regular. ... rise in the back of the north level is poor.—Labrugere: In the adit level ... Laplanche the lode is unproductive. The cross cut at the Moulin de ... entered soft, disordered ground, but has not met with anything of ... during the last month's driving.

MONTE ALBO.—W. Martin, Feb. 2: Su Ergiolu: The new ... has now attained the depth of 17 metres below the No. 4 level, and is being ... tinued by nine men; the lode is not so good to-day as when last reported, ... but is yielding for size of shaft ½ ton of ore per metre. In No. 4 level, ... north from the new shaft, the lode is about 20 inches wide, producing ... stones of ore. In the winze sinking in the bottom of this level, south of ... shaft, the lode is yielding for size of winze ½ ton of ore per metre. ... two stopes in the back of No. 4 level, yielding ¼ ton per metre, and one ... ing ½ ton per metre.—Guzurra: Julius Cæsar cross-cut is still being ... and the ground is more favourable for driving than it has been. ... going east from the bottom of winze, under Julius Cæsar level, is at ... poor. In Julius Cæsar level, driving west on lode B, the lode is about ... wide, composed of quartz, blende, and schist, intermixed with spots of lead ... but not of sufficient quantity to value. In the same level on lode A, the ... 1 metre wide, composed of quartz and blende, producing good stones of ... grained lead ore. We are just entering the ore ground which the former ... of the mines had in the bottom of Santa Clare level, that was abandoned ... them on account of the large quantity of water that existed. I have been ... formed that this column of ore is 60 meares long, if so should it be ... reported here we shall soon be able to increase our returns. In Napoleon ... south, the lode is 4 feet wide, composed of quartz, white iron, and blende ... termixed with spots of copper ore. The stope in the back of this level is ... ing ½ ton of ore per metre. Galleria Nuova is still being continued; the ... at present small and poor. We are driving this level across the valley from ... mountain to the other, and until we get this level well into the other ... settled ground we shall not get any mineral ground. I think we have ... to 20 metres more to drive to cross the valley. The winze in the bottom of ... Lucifer level is being continued, and is without change since last report. ... have the greater portion of the machinery here on the mine, and the ... are getting on as fast as possible with the engine-houses and crusher-house.

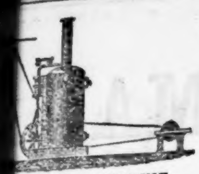
[For remainder of Foreign Mines see to-day's Journal.]

MINING GLOSSARY.—The third edition of the Glossary of Mining and Smelting Terms has now been printed, and contains carefully compiled lists of the technical terms used in the mines of Cornwall, Derbyshire, South Staffordshire, Newcastle, and Spain; and of the smelting terms used in France and Germany. The book, which ... be found extremely valuable to those interested in mines desiring thoroughly to comprehend the agents' reports, will be forwarded from the *Mining Journal* office, 26, Fleet-street, E.C., on receipt of ... may be obtained, by order, through any bookseller or newsagent.

STEAM BRAKE FOR WINDING-ENGINES.—A new arrangement of ... brake has been applied to some of the winding-engines in France. The brake cylinder, instead of having, as usual, an upper cover, communicates by the whole of its area with a steam chamber, of which the capacity is about threfold the volume of the cylinder. The ... of the valve chest has three openings; the lowest serves to admit the steam ... low the piston, the upper one opens the steam into the cylindrical chamber, ... of course, upon the upper face of the piston, and the intermediate one serves ... the exhaust. The slide valve has its upper side enlarged, and pierced with ... rectangular opening, corresponding to the the highest opening of the ... When the brake is not in operation the valve uncovers the highest and ... openings, so that the steam acts equally on both sides of the piston. If the ... be moved, for which purpose a lever moved by hand is suitably arranged, ... lowest opening remains free, and the steam continues to act on the under ... of the piston; but the upper opening closes gradually, and soon the steam ... tained in the upper chamber becomes confined. If the valve is again varied ... upper opening begins to communicate with the exhaust, and gradually the ... escapes. This movement is rendered progressive by the special form ... the upper opening. By reason of this slow escape the piston forced upward ... below by the steam is moved slowly, and the brake is gradually put in ... A gauge placed before the workman allows him to regulate the movement of ... the brake with the utmost nicety.

MANUFACTURE OF STEEL AND IRON.—The object of the invention of Mr. P. A. DORMOY, of Paris, is the economical manufacture of homogeneous steel and iron, tempered, pulverised, cast, and forged with coke or coal by means of apparatus having hearths, the flames of which are inverted, double ... canal regenerator, and regulator of the gases, and fusing basin. The same ... is employed in the apparatus whether for the fusion or refining metal. ... separated the grain metal in projecting it at a white heat in a current of ... water, which purifies it and facilitates its crushing, he makes an intimate ... ture of the metal so crushed, and he assures himself of its homogeneousness ... taking small quantities of the metal from different parts of the mass, and ... a separate analysis of them, which he compares. When there is a too ... difference, he adds to the mixture a sufficient quantity of carbonising or ... bonising matters till he obtains the desired quality, and from that time ... operate on the largest masses with the certitude that the metal manufactured will be always identical.

WARMING RAILWAY CARRIAGES.—The invention of Mr. ... WOOD, of Northumberland-street, Strand, consists of introducing hot or ... air into railway carriages at the discretion of the passengers, by means of ... or tubes running the whole length of the train, which are fitted with bell ... placed in front or sides of the engine. The speed of the engine will force ... air through the smoke-box or fire of the engine, through which the tubes ... where the air is heated, and thence into the carriages. He also introduces ... air into the carriages by means of similar pipes, which run the whole length ... the train, without passing through the engine smoke-box or fire. Each compartment to be supplied with taps in connection with either the hot or cold pipes passing through, which can be turned on or off at the pleasure of the passengers.



CHAPLIN'S PATENT STEAM ENGINES & BOILERS

(PRIZE MEDAL, INTERNATIONAL EXHIBITION, 1862),

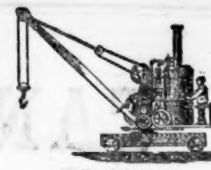
The ORIGINAL combined Vertical Engines and Boilers, introduced by Mr. CHAPLIN in 1855. Each class kept in Stock for Sale or Hire.

WIMSHURST, HOLLICK, & CO., ENGINEERS,

WORKS: REGENT'S PLACE, COMMERCIAL ROAD EAST, LONDON, E.

(At Regent's Canal, near Stepney Station).

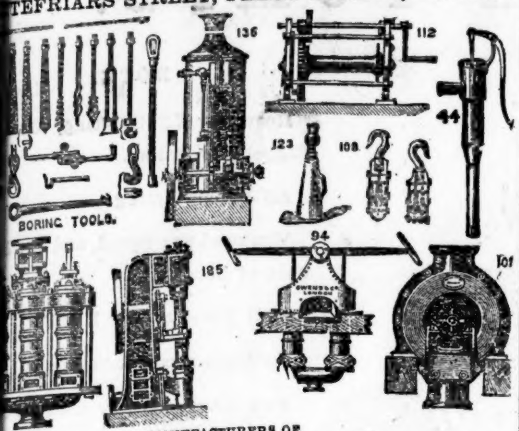
CITY OFFICE: 117, CANNON STREET, LONDON, E.C.



…S. OWENS AND CO.,

Hydraulic and General Engineers,

…TEFRIARS STREET, FLEET STREET, LONDON

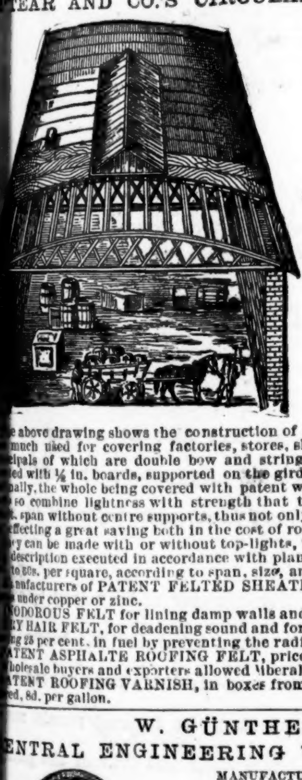


MANUFACTURERS OF

…ING TOOLS, for testing ground for Minerals, Bridge Foun…tions, Artesian Wells, &c., to any depth.
…26.—Treble Barrel and other Deep Well Pumps.
…136.—Vertical and other Portable Steam-engines.
…185.—Horizontal and Vertical Steam Pumping-engines.
…112.—Single and Double-purchase Crab Winches.
…108.—Pulley Blocks of all sizes.
…123.—Bottle and other Lifting Jacks.
…94.—Double-barrel Pumps, for Mine or Quarry use
…44.—Portable Wrought-iron Pumps, ditto ditto
…102.—Bernays's Patent Centrifugal Pumps, of all sizes.

ALSO EVERY OTHER DESCRIPTION OF
HYDRAULIC AND GENERAL MACHINERY,
COMPRISING
…RINES, WATER WHEELS, WIND ENGINES,
…HE HYDRAULIC RAM, FIRE ENGINES, &c.
Catalogues and Estimates on application.

…TEAR AND CO.'S CIRCULAR FELT ROOFING



FOR
GREAT ECONOMY
AND
CLEAR WIDE SPACE.

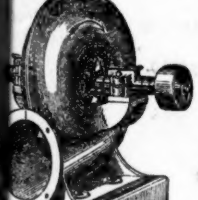
For particulars, estimates, and plans, address,—

M'TEAR & CO.,
20, BUDGE ROW, CANNON STREET, LONDON;
54, PORTLAND STREET, MANCHESTER;
OR,
CORPORATION STREET, BELFAST.

…e above drawing shows the construction of this cheap and handsome roo… much used for covering factories, stores, sheds, farm buildings, &c., the …cipals of which are double bow and string girders of best pine timber …ed with ½ in. boards, supported on the girders by purlins running longi…ally, the whole being covered with patent waterproof roofing felt. These …so combine lightness with strength that they can be constructed up to … span without centre supports, thus not only affording a clear wide space …ffecting a great saving both in the cost of roof and uprights.
…ey can be made with or without top-lights, ventilators, &c. Felt roofs of … description executed in accordance with plans. Prices for plain roofs from …to 60s. per square, according to span, size, and situation.
…anufacturers of PATENT FELTED SHEATHING, for covering ships' bot… under copper or zinc.
…ODOROUS FELT for lining damp walls and under floor cloths.
…Y HAIR FELT, for deadening sound and for covering steam pipes, thereby …ng 25 per cent. in fuel by preventing the radiation of heat.
…ATENT ASPHALTE ROOFING FELT, price 1d. per square foot.
…holesale buyers and exporters allowed liberal discounts.
…ATENT ROOFING VARNISH, in boxes from 3 gallons to any quantity re…ed, 8d. per gallon.

W. GÜNTHER,

…ENTRAL ENGINEERING WORKS OLDHAM,



MANUFACTURER OF MOST IMPROVED

Silent Fans for blowing and exhausting.
" " and Steam Engines combined, for ventilation.
Direct-acting Steam Fans.
Centrifugal Pumps and Pumping Engines.
Turbine Water Wheels, for high and low falls, and variable quantities of water.
Cast-iron Smiths' Hearths.
General Engineering Work.

ILLUSTRATED PRICE LISTS AND REFERENCES ON APPLICATION.

HEPBURNS' * PUMP LEATHER * WATERPROOF

…y a special method of preparation, this leather is made solid, perfectly close …exture, and impermeable to water; it has, therefore, all the qualifications …ential for pump buckets, and is the most durable material of which they can …made. It may be had of all dealers in leather, and of

I. AND T. HEPBURN AND SONS,

…ANNERS AND CURRIERS, LEATHER MILLBAND AND HOSE PIPE MANUFACTURERS,

LONG LANE, SOUTHWARK, LONDON.

Prize Medals, 1851, 1855, 1862, for
…ILL BANDS, HOSE, AND LEATHER FOR MACHINERY PURPOSES.

AWARDED TWENTY GOLD AND SILVER FIRST-CLASS PRIZE MEDALS.

IMMENSE SAVING OF LABOUR

TO MINERS, IRONMASTERS, MANUFACTURING CHEMISTS, RAILWAY COMPANIES, EMERY AND FLINT GRINDERS, McADAM ROAD MAKERS, &c., &c.

BLAKE'S PATENT STONE BREAKER,

OR ORE-CRUSHING MACHINE,

FOR REDUCING TO SMALL FRAGMENTS ROCKS, ORES, AND MINERALS OF EVERY KIND.

This is the only machine that has proved a success. This machine was shown in full operation at the Royal Agricultural Society's Show at Manchester, and at the Highland Agricultural Society's Show at Edinburgh, where it broke 1½ ton of the hardest trap or whinstone in eight minutes, and was AWARDED TWO FIRST-CLASS SILVER MEDALS. It has also just received a SPECIAL GOLD MEDAL at Santiago, Chili.

It is rapidly making its way to all parts of the globe, being now in profitable use in California, Washoe, Lake Superior, Australia, Cuba, Chili, Brazil, and throughout the United States and England.

Read extracts of testimonials:—

The Parys Mines Company, Parys Mines, near Bangor, June 6.—We have had one of your stone breakers in use during the last 12 months, and Capt. Morcom reports most favourably as to its capabilities of crushing the materials to the required size, and its great economy in doing away with manual labour.
For the Parys Mining Company,
H. R. Marsden, Esq. JAMES WILLIAMS.

The Van Mining Company (Limited), Van Mines, Llanidloes, Feb. 6, 1871.—Our machine, a 10 by 7, is now breaking 180 tons of stone for the crusher every 24 hours. I may say, of all our machinery, that for simplicity of construction and dispatch in their work, they are equal to anything in the kingdom, but your stone breaker surpasses them all. W. WILLIAMS.
H. R. Marsden, Esq., Leeds.

Chacewater, Cornwall, Jan. 27, 1869.—I have great pleasure in stating that the patent stone breaker I bought of you some three years ago for mines in Chili, continues to do its work well, and gives great satisfaction. It crushes the hardest copper ore stone—put it through ½ inch size by horse power—with great ease. I can safely recommend it to all in want of a crusher; can be driven by steam, water, or horse power.
H. R. Marsden, Esq. JAMES PHILLIPS.

Terras Tin Mining Co. (Limited), near Grampound Road, Cornwall, Jan. 1871.—Blake's patent stone crusher, supplied by you to this company, is a fascination—the wonder and admiration of the neighbourhood. Its simplicity is also surprising. Persons visiting it when not at work have been heard to remark, "This can't be all of the machine." It will crush to a small size from 8 to 10 tons of very hard and tough elvan rock per hour; taking into its leviathan jaws pieces of the hardest rock, weighing 200 lbs. or more, masticating the same into small bits with as much apparent ease and pleasure as does a horse his mouthful of oats. On every 100 tons of the rock crushed by the machine there is a direct saving to the company of not less than £5 over the process of hand labour previously adopted by them, and the indirect saving much more, the machine being ever ready to perform the duties required of it. It breaks the stuff much smaller, and in form so fitted for the stamps, that they will pulverise one-third more in a given time than when performed by hand labour.
JOS. GILBERT MARTIEN.
H. R. Marsden, Esq., Leeds.

Welsh Gold Mining Company, Dolgelly.—The stone breaker does its work admirably, crushing the hardest stones and quartz. WM. DANIEL.

Ovoca, Ireland.—My crusher does its work most satisfactorily. It will break 10 tons of the hardest copper ore stone per hour.
WM. G. ROBERTS.

General Frémont's Mines, California.—The 15 by 7 in. machine effects a saving of the labour of about 30 men, or $75 per day. The high estimation in which we hold your invention is shown by the fact that Mr. Park has just ordered a third machine for this estate. SILAS WILLIAMS.

Your stone breaker gives us great satisfaction. We have broken 101 tons of Spanish pyrites with it in seven hours. EDWARD AARON,
H. R. Marsden, Esq. Weston, near Runcorn.

For illustrated catalogue, circulars, and testimonials, apply to—

H. R. MARSDEN, SOHO FOUNDRY,

MEADOW LANE, LEEDS,

ONLY MAKER IN THE UNITED KINGDOM.

THE DON ECONOMIC LUBRICATING OIL

IS 40 PER CENT. CHEAPER THAN THE ORDINARY KINDS.

ECONOMIC LUBRICATING OIL. THE DON

MR. ALFRED HEWLETT, of the Wigan Coal and Iron Company, says:—"I have used it for two years, and find it to answer exceedingly well for lubricating purposes."

MR. NASMYTH, the Inventor of the Steam-Hammer, says:—"I am highly pleased with it as a most effective and durable lubricant, having remarkable properties in the way of setting free bearings which had got set fast."

In face of these and hundreds of other letters to the same effect, it is a MERE WASTE OF MONEY to use the dearer kinds for the engines and machinery of collieries and mines, numbers of which are now using the Don Oil instead.

Any company desirous of trying it before adopting it may do so at our risk and expense.

Circulars containing particulars sent on application.

PRICE—By the Ton of 253 Gallons, 2s. 6d. a gallon; by the Cask of 40 Gallons, 2s. 9d.

AGENTS WANTED AT HOME AND ABROAD.

DUNCAN BROTHERS,

MANAGERS,

DON OIL COMPANY, 2, BLOMFIELD STREET, LONDON, E.C.

CHAS. PRICE AND CO.'S RANGOON ENGINE OIL,

AS SUPPLIED TO H.M. DOCKYARDS AND FLEET.

THIS OIL is suitable to every kind of Machinery. As a lubricant it is equal to the best Sperm or Lard Oil, while it possesses the great advantage of being entirely free from any principle which wil corrode the metal bearings.

For particular kinds of Machinery, the Oil may be specially prepared of a consistency and character adapted to the nature of the work to be done.

"Chemical Laboratory, 7, Printing House-square, Blackfriars, April, 1869.

"I herewith certify that the Rangoon Engine Oil, manufactured by Messrs. Chas. Price and Co., is free from any material which can produce corrosion of the metal work of machinery. It is indeed calculated to protect metallic surfaces from oxidation.

"The lubricating power of this oil is equal to Sperm or Lard Oil.

"T. W. KEATES, F.C.S., &c. &c.

Every parcel of the Oil sent from the work bears the Trade Mark of the Firm.

LONDON: CASTLE BAYNARD, UPPER THAMES STREET.
WORKS: MILLWALL, POPLAR; and ERITH, KENT

London: Printed by RICHARD MIDDLETON, and published by HENRY ENGLISH (the proprietors), at their office, 26, FLEET STREET, E.C., where all communications are requested to be addressed.—Feb. 17, 1874.